This magazine is published to promote sound thought upon and concerning industrial medicine and traumatic surgery. To that end it will contain articles, news items, reports, digests and other presentations, together with editors' comments. The editorial policy is to encourage frank discussion. On this basis contributions are invited.

Industrial Medicine

Reg. U. S. Pat. Off.

The editors will exercise care in checking on the accuracy of data printed, but in all other respects articles and opinions of which expression is allowed are the opinions of their authors—the editors reserving in all cases the right to comment on the same, in the current or any subsequent issues, as they may be inclined.

The Journal of Occupational Diseases and Traumatic Surgery

The Science, the Law and the Economics of Industrial Health

Volume 7 JULY, 1938 Number 7

The Industrial Physicians and Surgeons

—The Twenty-Third Annual Meeting of the American Association of Industrial Physicians and Surgeons, and Second Midwest Conference on Occupational Diseases, Chicago, June, 6, 7, 8, and 9, 1938—

MORE explicit of the scope and breadth of industrial medicine than any single group of presentations ever given, was the program of this Twenty-Third Annual Meeting of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS and SECOND MIDWEST CONFERENCE ON OCCUPATIONAL DISEASES. And more significant in representation of the scientific, technical and economic importance of this field than any group of interested persons ever gathered together, was the assembly that heard it.

The first statement is borne out by the presentations themselves. There were 35 of them—and all were first-class, some superlative, some brilliant. The second can be confirmed by any reader of the papers as they are published; the response of each to the timely interest in industrial hygiene, occupational diseases, industrial medicine, and industrial and traumatic surgery is such as to *attract* those who, because of the problems of their respective situations, possess the interest.

The papers were too complete to be published in a single issue, and too thoroughly developed to be abstracted without an unwarranted intrusion upon the scope and treatment so distinctive of each. They will, therefore, be published in successive issues of this magazine—all of them, with illustratons almost as numerous as those used in the initial presentations. This with the single exception of the paper on "Metallic Fixation of Bones," by DR. WILL T. LYON, as to which DR. LYON had previously given the right of original publication to *Surgery, Gynecology & Obstetrics.*

Thirteen of the papers are included in this issue. They appear in the sequence of their places on the program. More will follow in August, and the remainder, in all probability, in September. Those published this month are indicated, in the following list of the whole 35, by the page numbers on which they will be found.

Monday, June 6.

THE first day was given over to "Industrial Hygiene." Under the chairmanship of DR. C. O. SAPPINGTON, the following papers were presented:

"The Engineer's Place in Industrial Hygiene," by WARREN A. COOK, Supt. Engineering Dept., Zurich General Accident & Liability Insurance Company, Ltd.

"The Insurance Company and the Control of Occupational Diseases," by J. B. LAMENZO, Research Engineer, Hartford Accident & Indemnity Company. (See page 370.)

"The Physician's Responsibility in Industrial Hygiene," by C. D. SELBY, M.D., Medical Consultant, General Motors Corporation.

"Engineering Aspects of Problems in Industrial Epidemiology," by J. J. BLOOMFIELD, P. A. Sanitary Engineer, Division of Industrial Hygiene, U. S. Public Health Service. (See page 377.)

"Plumbing as an Industrial Hygiene Problem," by MAJOR JOEL I. CONNOLLY, Assistant to the President, Chicago Board of Health.

"Industrial Hygiene and the Nurse," by JOANNA M. JOHNSON, R. N., Supervisor of Nurses, Employers Mutuals, Wausau, Wisconsin. (See page 385.)

AT THE evening meeting, at which DR. CAREY P. MCCORD presided, WILLIS H. CARRIER, chairman of the Board, Carrier Corporation, read a paper on "Air Conditioning in Industry," and DR. HOLMBLAD reported on the status of certain matters of "Policies and Problems" being studied by committees of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, and the American Society of Heating and Ventilating Engineers, with reference, principally, to the development of a terminology such as will enable physicians and engineers to cooperate more understandingly.

Tuesday, June 7.

THIS was "Occupational Diseases" day. With DR. WM. D. MCNALLY as Chairman of the morning Session, and DR. ANDREW M. HARVEY presiding during the afternoon, the following presentations were made:

"Contact Dermatitis," by MICHAEL EBERT, M.D., Associate Professor of Dermatology, Rush Medical College.

"Practical Problems Under Blanket Coverage for Occupational Diseases: A Review of the Illinois Claim Experience," by CLARK BRIDGES, Casualty Mutual Insurance Company. (See page 390.)

"Noise in Industry," by WALLACE WATERFALL, Director of Research Engineering, the Celotex Company.

"Developments in Occupational Diseases Legislation," by OLIVER G. BROWNE, General Claims Attorney, New York Central System. (See page 394.)

"Women in Industry," by M. H. KRONENBERG, M.D., Chief of Division and Industrial Medical Supervisor, State of Illinois Department of Public Health.

"Light, Vision, and Seeing," by MATTHEW LUCKIESH, D.Sc., Director, and FRANK K. MOSS, Physicist, Lighting Research Laboratory, General Electric Company.

"Tuberculosis and Its Relation to Silicosis," by O. A. SANDER, M.D. (See page 399.)

"The Employability of the Silicotic," by VOYTA WRABETZ, Chairman, Industrial Commission of Wisconsin. (See page 405.)

Wednesday, June 8.

THE Twenty-Third Annual Meeting of the American Association of Industrial Physicians and Surgeons was opened officially this day, by the President's Address of DR. ROYD R. SAYERS.

The general tenor of the proceedings was "Industrial Medicine." DR. FREDERICK W. SLOBE was Chairman during the morning, and DR. CASSIUS WATSON presided, during the afternoon, while the program prepared and presented by the Association for the Advancement of Industrial Medicine and Surgery—which began with DR. CURRENCE's paper—was given.

The morning program was as follows:

"Hazards of Night Driving," by HART E. FISHER, M.D., F.A.C.S., Medical Director, Chicago Rapid Transit Company.

"Factors Determining Reasonable and Equitable Temporary Total Disability Periods," by PHILIP H. KREUSCHER, M.D., F.A.C.S., Chief Surgeon, Chicago Area, Carnegie-Illinois Steel Corporation; Former Medical Director, Industrial Commission of Illinois.

"The Occupational Diseases Research Department of Northwestern University," by FRED FITZ, M.D., Northwestern University Medical School.

"Syphilis in Industry," by HAROLD A. VONACHEN, M.D., Medical Director, Caterpillar Tractor Company. (See page 416.)

The afternoon program included:

"Arthritis in Industry," JOHN D. CURRENCE, M.D.

"Tuberculosis in Industry," by GEORGE G. ORNSTEIN, M.D., F.A.C.P. (See page 419.)

"Intra-Articular Damage," by WILLIS W. LASHER, M.D., F.A.C.S.

"Lead Poisoning in Industry," by IRVING GRAY, M.D., F.A.C.P.

THE Annual Banquet, with DR. WILLIAM A. SAWYER as Presiding Chairman, featured the paper by HARVEY G. ELLERD, Personnel Director of Armour and Company, on "Employability of Persons Presenting Disability or Disease." The discussions developed a very respectable symposium of experiences and opinions on the subject. (See page 430.)

Thursday, June 9.

"SURGERY" day, under the chairmanship of DR. C. D. SELBY, began with the program presented by the Institute of Traumatic Surgery, as follows:

"Discussion of Fat Embolism," by CARLO S. SCUDERI, M.D., F.A.C.S. (See page 436.)

"Trauma to Blood Vessels, and Their Sequelae," by RAYMOND W. MCNEALY, M.D., F.A.C.S.

"Distinction Between Injuries of Spine, Spondylitis, and Spondylosis," by JOHN D. ELLIS, M.D., F.A.C.S.

"Pectin in the Treatment of Wounds," by JAMES E. M. THOMSON, M.D., F.A.C.S. (See page 441.)

"Metallic Fixation of Bones," by WILL T. LYON, M.D.

In the afternoon the Chicago Regional Fracture Committee of the American College of Surgeons, with DR. E. C. HOLMBLAD as Chairman, gave the following symposium:

"Fracture of the Carpal Navicular Bone," by KELLOGG SPEED, M.D., F.A.C.S.,

"Prevention vs. Cure in Deformity Following Fracture," by PAUL B. MAGNUSON, M.D., F.A.C.S.

"March Foot," by DEAN L. RIDER, M.D.

"Treatment of Fractures of the Neck of the Femur by Pinning," by WILLIS J. POTTS, M.D., F.A.C.S.

"Treatment of Fractures of the Neck of the Femur," by HUGH MCKENNA, M.D., F.A.C.S.

THE election of officers and directors resulted as follows:

President: C. D. SELBY, M.D., Medical Consultant, General Motors Corporation.

President-Elect: MCIVER WOODY, M.D., Standard Oil Company of New Jersey.

1st Vice-President: DANIEL L. LYNCH, M.D., Medical Director, New England Telephone & Telegraph Company.

2nd Vice-President: LLOYD NOLAN, M.D., Tennessee Coal, Iron & Railroad Company.

Secretary-Treasurer: VOLNEY S. CHENEY, M.D., Medical Director, Armour and Company.

The directors for the 1938-1940 term are:

J. B. McConnaughy, M.D., Medical Director, Aluminum Company of America.

Carey P. McCord, M.D., Director, Bureau of Industrial Hygiene, City of Detroit.

R. R. Sayers, M.D., U. S. Public Health Service.

Loyal A. Shoudy, M.D., Chief of Medical Service, Bethlehem Steel Corporation.

Frederick W. Slobe, M.D., Medical Director, Sinclair Refining Company.

J. J. Wittmer, M.D., Medical Director, Brooklyn Edison Company.

Dr. Cheney's new term as Secretary-Treasurer is his twelfth.

THE Convention was well attended. The registration exclusive of exhibitors' representatives, was in excess of 1,000.

The exhibits were interesting and instructive. A summary of these begins on page 445.

Among the many press references to the Convention, the outstanding papers, and the physicians and surgeons in attendance, is the following from *Time* (June 17, 1938):

"Fifteen million men and women who work for a living get free medical examinations, free medical care for injuries and illness incurred in line of employment—all at the expense of their employers. The employers figure it saves them money in the long run. Last week, 1,500 doctors who look after those 15,000,000 met in Chicago for the annual convention of the American Association of Industrial Physicians and Surgeons. They figured that the yearly cost to industry due to illness of workers is $6,000,000,000.

"The welfare of the 2,000,000 women factory workers held the convention's interest. Illinois' Industrial Hygienist Milton Henry Kronenberg reminded his colleagues that women 'are less resistant to dust, fumes and gases [than men], more susceptible to poisons, monotony and fatigue. . . . Married women are a particular problem. The stillbirth percentage is greater among factory workers. Infant mortality is higher. Abortions are higher.' His recommendation to prevent all this: pre-employment physical examinations, followed by frequent periodic checkups, prohibiting females in employments involving exposure to lead and benzol; proper seating, with back rests; prohibiting women from working three months prior to and after childbirth; prohibiting night work; clean lunch rooms; quiet rest rooms; an educational program emphasizing female health; adequate nursing and medical care, and short rest periods during the morning and afternoon hours.

"Syphilis is another concern of industrial medicine. Caterpillar Tractor Co.'s Harold Vonachen reported that the syphilitics of their Peoria, Ill. plant are kept at work as long as they follow treatment by their family doctors. He discovered that 400 of the 10,000 employees had syphilis. Only two refused treatment. They lost their jobs."

A crystallization of the discussions at the Monday evening meeting is well given in another press comment, by P. Donald Horgan, Air-Conditioning Editor of the *Chicago Evening American* (June 13).

"Twenty-five million people, about one in every five of the total population of this country, are exposed to health hazards of one kind or another due to the conditions of the air in places of industrial employment.

"For these workers the hazards present themselves in the form of dust, gases, toxic fumes, vapors or high temperatures and humidities which can be controlled, regulated or eliminated by air conditioning.

"Added to this total are five million more employed in agriculature who are also exposed to some form of air contamination or undesirable conditions. Many of these work in the open air and are therefore beyond the reach of improved surroundings such as can be created indoors by air conditioning.

"In other words, of the 50 million people gainfully employed in normal times, 30 million are exposed to industrial hazards of one kind or another from the surrounding air.

"These astonishing figures, giving some idea of the enormous part that air conditioning has to play in the field of industrial health alone were brought before the American Association of Industrial Physicians and Surgeons, in session here at the Palmer House for the greater part of last week.

"Occupational diseases and the health conditions among industrial employees are the concern of this body and one of the weapons used in the battle against afflictions arising from air-borne impurities and other unwholesome surroundings is air conditioning.

"Dusts, toxic fumes, gases, vapors, etc., unavoidable to some extent in many industrial processes, are not only a peril to the health of millions of workers but an increasing economic drain on industrial management as well.

"Air conditioning originated in industry over 30 years ago. Its first use was in certain industrial processes such as printing, textile and tobacco fabrication, where definite air conditions are required for the best results. Desirable temperature and humidity in these and in a number of other industries improve the product and increase the rate of production.

"More recently the value of air conditioning in safeguarding the health of employees in many industries has been recognized and it is now finding increased use in the improvement of the surroundings of workers. In those industries where hazards to health are carried as a result of the manufacturing processes, the control, regulation or elimination of these injurious elements now make these occupations safer than they ever were before.

"In industries where high temperature or excessive humidity prevail as a result of the manufacturing processes air conditioning has reduced these to more nearly the normal degree and has lengthened the hours that men can work and has increased their efficiency and earning power.

"This has been demonstrated in steel mills where exceedingly high temperatures are encountered

and also in deep mines where a saturated condition of the air due to evaporation of ground water combined with the high natural temperature of the rock creates conditions comparable to those of the tropics in which men can work for only a few hours at a time and only those who are more or less acclimated to such conditions can work at all.

"A study of such situations is the province of the industrial physician and surgeon. Through his cooperation with the air conditioning engineer the most desirable working surroundings both from the standpoint of efficient manufacture and the health of the workers can be created.

"It is impossible to dissociate the humane from the economic considerations in industrial health. It is as important to the employer and the employee in one aspect as another.

"Highly skilled workers in any process of manufacturing represent an investment on the part of the employer. It is to his interest as well as the welfare of the community that the health of his workers should be such that they will be able to keep their earning power at the maximum and maintain the highest standards of living."

[NOTE: *From here to page 445 the Convention papers follow in sequence.*]

The Insurance Carrier and the Control of Occupational Diseases

J. B. LAMENZO,
Research Engineer,
Hartford Accident and Indemnity Company,
Hartford, Connecticut

AS MEDICAL men, you are interested in workers of average health. When you find a worker below par, you prescribe for him. When you find a prospective worker below par, you advise him. You are always striving to bring the-below average up to averoge, and to raise the average to better than average. It is only humanly natural for those with the ability to improve others to continually strive for that improvement.

We in the insurance business are no different. In our business we, too, are concerned with averages—only in our case it is the average or less than average risk which we try to improve. The question, "What is the average risk?," often arises so far as the occupational disease phase of the casualty insurance business is concerned, and there are two criteria which serve us in arriving at a conclusion:

1. Experience;
2. Physical Conditions.

Experience (that is, the money received from the insured in premiums compared with the money paid out in defending and settling claims) is a valuable indicator of the quality of a risk for compensation for accidents, but with an occupational disease risk, especially where the disease is progressive, and where disability develops slowly over a long period of years, and where a single case may be sufficient to put the risk in the red for a long, long time, experience is an exceptionally poor indicator.

The existence of certain physical conditions as an index of the quality of a risk seems to be more reliable in the latter case. The physical condition of industrial operations which produce diseases the causes of which we know and are fully equipped to prevent, is, of course, the paramount factor. In following the theory that the below-average risk ought to be made average, or the average risk ought to be made better than average, it is, first of all, necessary to make sure that the risk is susceptible of improvement.

THE greatest problem today seems to lie in the control of dust. Dust, which the Greek philosophers so aptly defined as "matter in the wrong place," should be treated as something foreign, like a cinder in one's eye to be removed and disposed of in a safe manner.

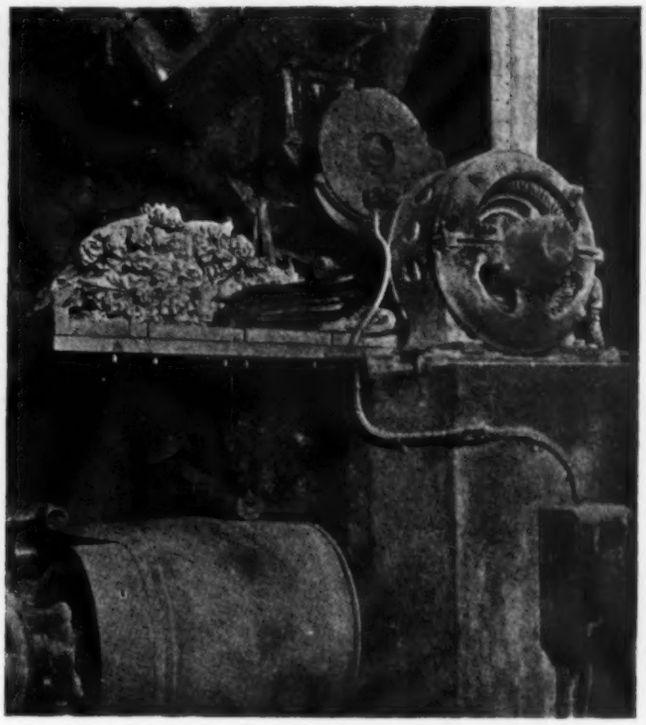
In connection with the dust problem, I am going to show certain below-average dust producing operations made average or better than average by the aid of adequate mechanical exhaust ventilation.

No. 1—Here is an exposure to a mixture of silica flour and soap used for household scouring powder. Too often this operation goes unnoticed so far as control is concerned. It is of interest to note the hood located at the rear of the filling machine with the center dividing plate so that high velocity air currents effectively remove dust clouds from the lower ends of the feeding spouts. You can see how clean the operator's station is—and this is due to the effectiveness of the exhaust.

No. 1. Packaging Household Scouring Powder (A Mixture of Silica and Soap Powder)

—Courtesy W. W. Sly Mfg. Co.

No. 2. Bagging Silica Flour—Uncontrolled



—Courtesy W. W. Sly Mfg. Co.

No. 3. Bagging Silica Flour—Controlled

No. 2—This slide shows how important it is to control dust at the point of origin. This Bates packer is being used to bag silica flour and without control the dust concentrations are terrific.

No. 3—The same operation (as shown in No. 2) conducted under adequate and effective mechanical exhaust ventilation.

No. 4—This slide shows a battery of bagging machines similarly controlled. Though not operating at the time the picture was taken, it is shown merely to indicate better plant conditions wholly attributable to the control of dust. Manufacturers of machinery which, due to their operation, generate dust should come to the realization that they, too, are connected with the problem and should lend their efforts to a satisfactory solution of it by fully cooperating with those whose primary aim is to control occupational diseases. If manufacturers of such machinery have no ventilation experts in their employ and the design of the equipment requires the application of exhaust, they should consult with the engineers of manufacturers who design and install dust collecting systems, so that the best results will be obtained.

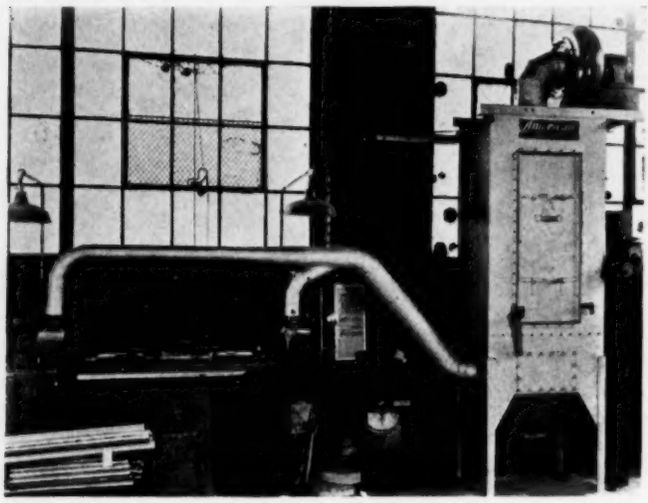
In considering the manufacturer of such machinery, we cannot very well lose sight of the purchaser, because he can play a most important part in the scheme of things. Is it beyond the realm of reason to expect the purchaser to demand that machinery or equipment which produces dust be properly designed for dust control and equipped with adequately sized connections, or, if it is a self-contained unit, with satisfactory exhaust ventilation? This attitude on the part of the purchasers of "dust producers" would accomplish wonders. One of the most important results would be a crystallization of thoughts on effective design of all types of industrial exhaust hoods.

No. 5—This slide indicates bulk packaging of scouring powder. Probably a more effective con-

—Courtesy W. W. Sly Mfg. Co.

No. 4. A Battery of Bagging Machines Properly Controlled

No. 5. Bulk Packaging of Scouring Powder



—Courtesy American Foundry Equipment Co.

No. 6. Control for Isolated Grinding and Buffing Operations

No. 7. Swing Frame Grinders—Properly Controlled

trol could have been obtained if there were a cone-shaped metal cover extending from the bottom of the overhead feed hopper to the top of the barrel.

No. 6—In practically every industry we run across isolated grinding and buffing operations being carried on uncontrolled because the cost of extensive piping systems is in many cases prohibitive. This slide shows how the manufacturers of dust collecting equipment have met this problem. Here we have a double stand grinding and polishing machine hooded and exhausted to a small-sized individual cloth-tube type dust arrester. Air from the clean side of the arrester is discharged to the outside of the building. We should see more of such installations in the future.

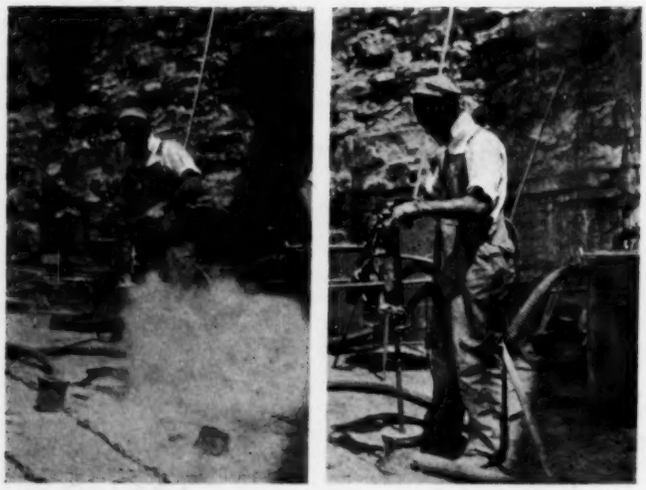
No. 7—Swing frame grinders usually present a picture of large unwieldy castings in dirty surroundings precluding any type of dust control. This slide shows swing grinding operations being carried on under excellent control. Much thought and ingenuity developed this system of control.

The dust which results from this operation is composed of steel particles and artificial abrasive containing less than 1% free silica. However, to the competent industrial ventilating engineer, high concentrations of any kind of dust in the working environment is not only objectionable, but also is unnecessary. He, therefore, aims to remove as much dust as is economically possible, if for no other reason than to improve the condition of the working environment and to minimize wear and tear on machinery.

No. 8—During the past few years, considerable work has been done in controlling dust resulting from rock drilling. Here we have rock drilling uncontrolled and controlled. One of the worst dust producing operations in rock drilling, the blowing of the holes, is entirely eliminated with this type of control.

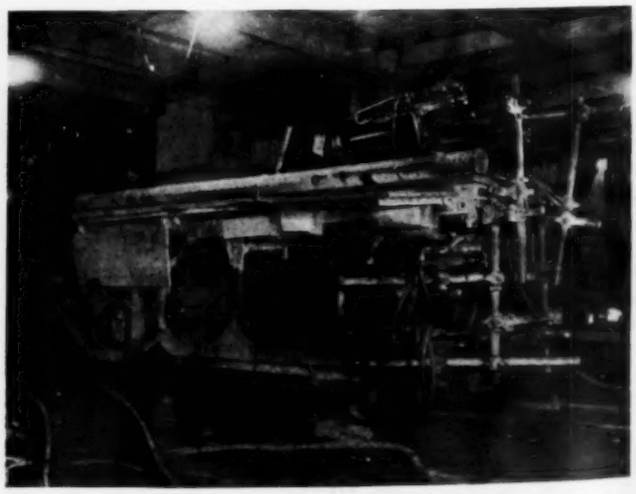
Nos. 9, 10 AND 11—Tunnel contractors in New York felt that the use of the type of control shown in the preceding slide was not suited for underground rock drilling. They preferred wet methods of control with auxiliary ventilation. A group of contractors financed experimental work which led to the development of a system which will be shown on the following slides.

The first slide (No. 9) shows the broadside of the apparatus which consists of the drill carriage mounting six pneumatic-feed drifter drills which are arranged in three pairs at the front. As you



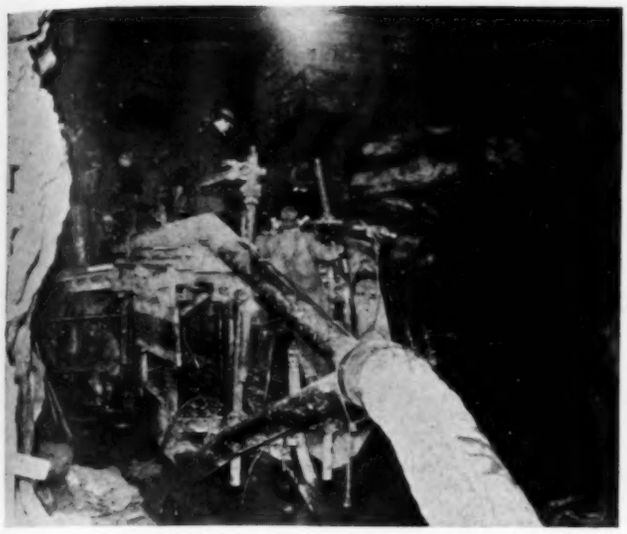
—Courtesy Spencer Turbine Co.

No. 8. Rock Drilling Uncontrolled and Controlled



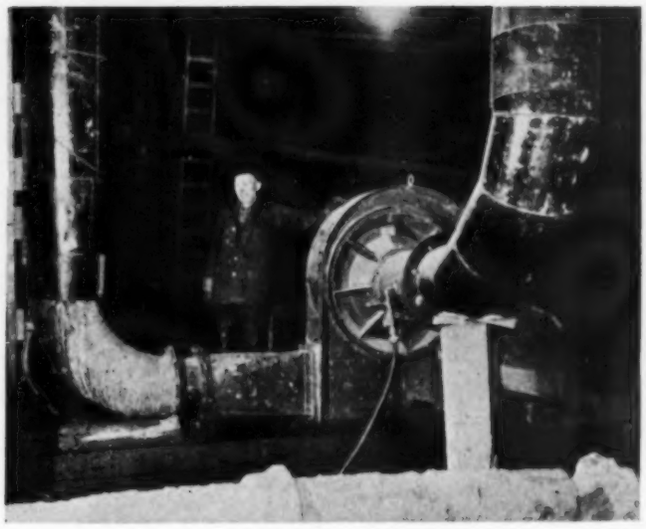
—Courtesy American Air Filter Co.

No. 9. Control Apparatus—Wet Method with Auxiliary Ventilation



—Courtesy American Air Filter Co.

No. 10. Confluence of the 10-inch Ducts



—Courtesy American Air Filter Co.

No. 11. Method of Ventilation Supply

will notice, running along both sides there are four 10-inch steel ventilating ducts, extending forward in the working zone of the drill operators, and all coming together at the rear of the carriage into a 20-inch manifold which is better shown in the next slide (No. 10). This manifold is connected to a 20-inch steel vent pipe by means of a non-collapsible flexible canvas tubing.

The third slide (No. 11) shows how ventilation is supplied. Sufficient ventilation is afforded by a centrifuge fan of special design with a capacity of 10,000 cubic feet of air per minute, located well back in the workings on the floor of the tunnel. At the inlet of the fan is a one-inch water connection feeding about five gallons of water per minute into the centrifuge. The water mixes with the incoming air and traps the dust. The water and dust together are thrown off the fan blades at a high speed into a side ring, passing off into a drain, while the effluent air shoots up an exhaust pipe to the street surface.

Though the fan has a capacity of 10,000 cubic feet of air per minute, during the experimental work in the tunnels of New York it was found that 4,800 cubic feet pulled through the vent pipes was sufficient when six drills were being operated.

Nos. 12 and 13—I have a number of pictures showing the progress that has been made in the stone cutting and polishing industry, but I shall show only two, to point out what this industry is doing and how they are doing it.

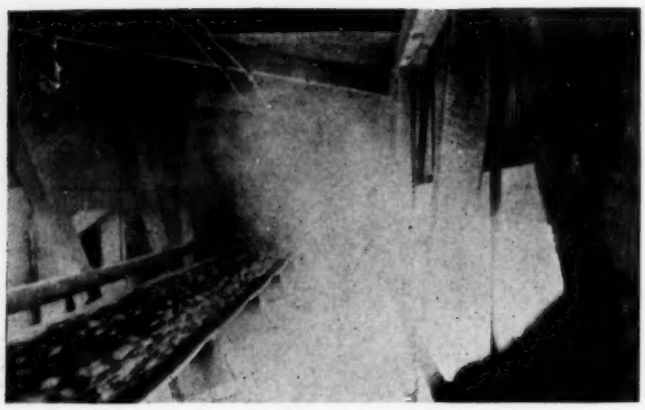
The first slide (No. 12) shows an uncontrolled operation as far as the tool is concerned. The operator, you will notice, has a respirator which has been approved by the United States Bureau of Mines for protection against the inhalation of silica dust.

The second slide (No. 13) shows exhaust applied to the tool in a manner which gives the operator absolute protection against inhalation of high dust concentrations.

A short time ago I had an opportunity to visit

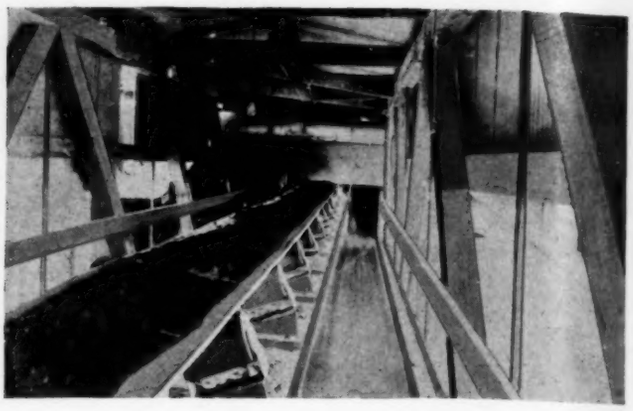
No. 12. Stone Cutting—Uncontrolled

No. 13. Stone Cutting—Controlled



—Courtesy W. W. Sly Mfg. Co.

No. 14. Crushed Rock Conveyor System—Uncontrolled



—Courtesy W. W. Sly Mfg. Co.

No. 15. Crushed Rock Conveyor System—Controlled

the granite industry in Vermont, and from by observations this industry not only realizes the extent and seriousness of its dust problems, but also has taken steps to control it. Many valuable lessons can be learned from the manner in which the stone workers of Vermont have handled the dust problem.

Nos. 14 AND 15—Rock crushing operations, irrespective of the kind of rock being processed, always produce high dust concentrations. The first slide (No. 14) shows how a normal conveyor system looks without any applied-control and the second (No. 15) shows how dust dispersion has been controlled at its source.

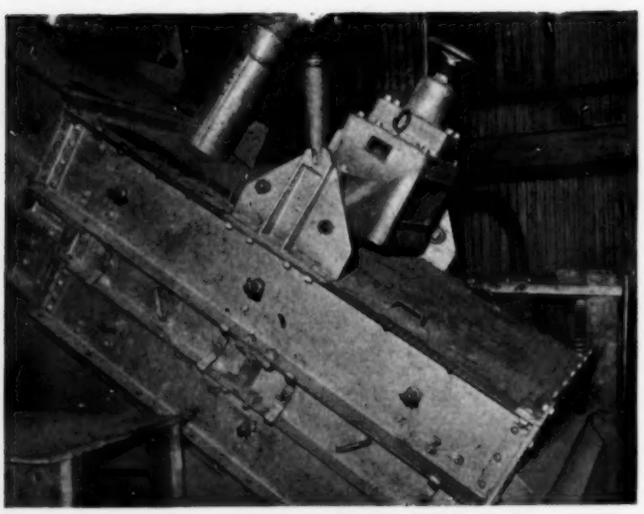
No. 16—Here is another operation which is usually allowed to disperse large volumes of dust. The effectiveness of enclosing and ventilating this automatic vibrating screen is demonstrated by this picture. This, incidentally, is a vibrating screen in a roofing granule plant.

No. 17—This shake-out or dumping operation as normally performed in many ferrous and non-ferrous foundries is uncontrolled—either from a ventilation standpoint or personal respiratory equipment. This job could very easily be controlled by the installation of a three-sided canopy set over the shake-out grate, provided with proper exhaust.

Nos. 18 AND 19—When we come to the shake-out of large castings, the next two slides present a story which requires very little explanation. The first slide (No. 18) shows the operation uncontrolled, while the second (No. 19) shows the effectiveness of the applied exhaust. Twenty thousand cubic feet of air per minute are exhausted through the enclosure.

No. 20—During the study of dust removal systems, consideration should also be given to better housekeeping in general. In spite of every precaution in controlling the dust at the source, there is bound to be a certain amount of the very fine particles accumulated on the floors, walls and rafters. Sweeping only stirs this all up, but, by the use of the heavy-duty type of vacuum cleaners that are now available, dustless cleaning can be accomplished (No. 21).

You have just seen a few of the many conditions responsible for the dispersion of dust and the control measures adopted. If these pictures do nothing more than emphasize the importance of adequate control, they will have served a useful purpose.

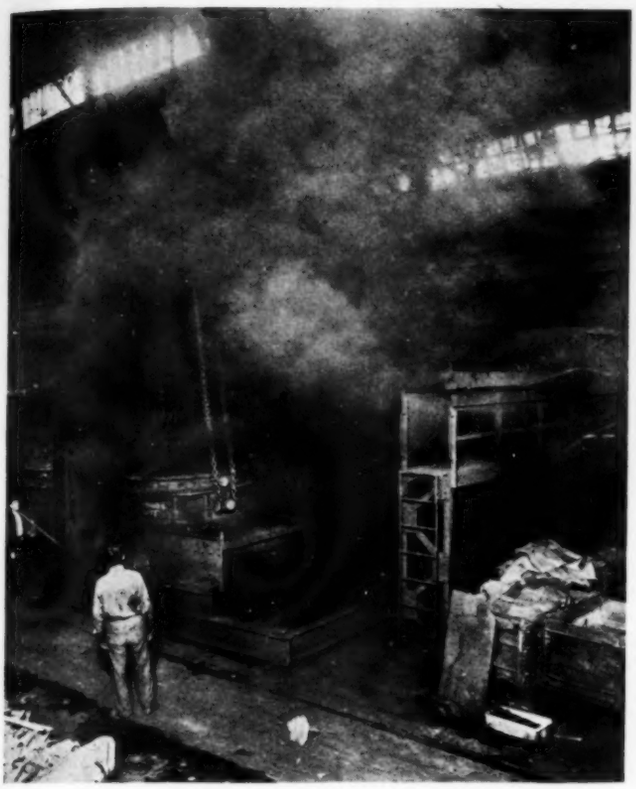


—Courtesy U. S. Dept. of Labor.

No. 16. Vibrating Screen in Roofing Granule Plant, Properly Controlled

—Courtesy U. S. Dept. of Labor.

No. 17. Shake-out of Small Castings—Uncontrolled

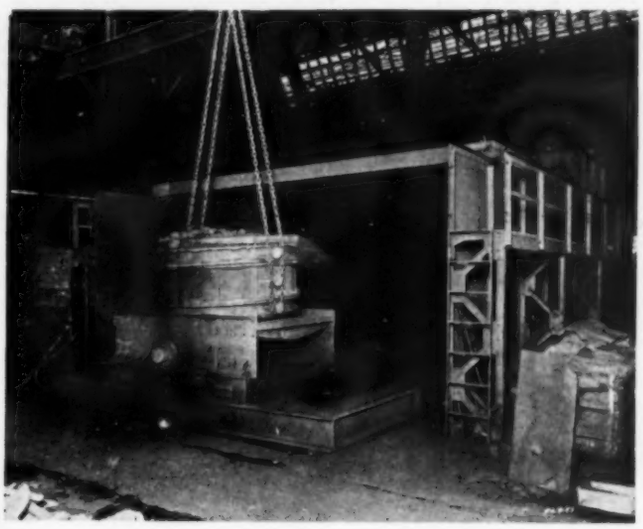


No. 18. Shake-out of Large Castings—
Uncontrolled

FOR the engineering control of dust, we depend in a large measure upon the ability of industrial ventilating engineers. This type of engineer understands the practical application of industrial dust control and tackles the problem from the standpoint of initial investment, cost of operation, and the result to be obtained. A good engineer,

—Courtesy U. S. Hoffman Mchy. Co.

No. 20. Brush Broom Sweeping—
The Old Method

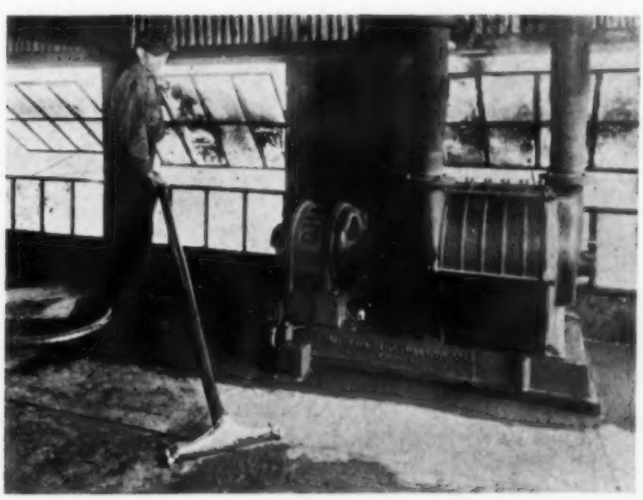


No. 19. Shake-out of Large Castings—
Controlled

in going after industrial dust, is interested primarily in the volume of air to be handled to suppress and control the dust, and designs equipment which will deliver results far in excess of threshold limits whether actual or arbitrary.

While it is expensive to install a dust control or a dust removal system, such a system is an asset, not a liability. It invariably shows a profit on the amount invested. When after due deliberation an appropriation is made for a dust removal system, executives should see to it that they are purchasing the best system available from the standpoint of air engineering and that, through this engineering, they will obtain practical results. The operating cost of a practical system, i.e., interest on investment, depreciation, maintenance and power, will be justified by improved working conditions, greater output per man, a better product, the aesthetic value of a clean plant, a saving of valuable materials and reduced wear and tear on machinery, as well as a reduction in health hazards.

The job of dust control does not end with the installation of dust arresting equipment. Proper



—Courtesy U. S. Hoffman Mchy. Co.

No. 21. Vacuum Cleaning—
The New Method

maintenance with periodic inspection is absolutely necessary to insure continued efficient operation.

As you well know, the success of any effort for the control of occupational diseases depends upon the ability of a group of three—consisting of a physician, an industrial hygienist, and the industrial ventilating engineer, to work together with enough knowledge of the other's problems to do so.

The first of the triumvirate, the doctor, occupies an important position. Without his support and cooperation, very little can be accomplished. It is he who tells us what concentrations are safe, and how long a worker may be exposed to certain concentrations without injury to health. It is he who interprets in terms of pathology the effects of exposures, and he prescribes treatment in case of disease.

The industrial hygienist makes a complete study of conditions in industry which are likely to constitute a hazard, and determines by means of physical and chemical tests the degree of hazard. He interprets the results of the determinations, and develops scientific data which are invaluable in the control of occupational diseases. The doctor and the industrial hygienist work closely together and have learned to talk each other's language.

The third member of the trinity, however, does not appear to be so fortunate. He is like an outsider brought in to do his job without, in many cases, knowing the reasons for it. The industrial ventilating engineer has knowledge which covers the application of proper type and size of fan, the layout of a piping system, scientifically designed. He also possesses knowledge of air and its flow in piping systems, covering such items as noise, resistance, turbulence, and the proper method of distribution, the design of hoods and the application of the proper type of cyclone, cloth-screen wet-type or electrical-precipitator dust arrester. He is the individual who is expected to develop and invent systems which in many cases have never been previously produced. It is upon his shoulders that the final responsibility rests as to whether the disease hazard has been controlled.

This whole problem of industrial ventilation as it pertains to the control of occupational diseases is a highly specialized field, requiring the development of a highly specialized type of engineer. Yet, what effort has been made to give him an industrial hygiene background so that he can work smoothly with the other two members of the triumvirate? In my opinion, the industrial ventilating engineer has to be taken into the fold—he has to be given the opportunity to learn to speak the language of his colleagues.

With this in mind, it appears as though the few universities and colleges which are prepared to give a complete course in industrial hygiene should do something about setting up a special course in industrial hygiene for the mechanical engineer who is either in the industrial ventilating field or who hopes to enter that field and become an industrial expert.

One of the important functions of such a course should be to give him an intelligent appreciation of the work of the other two. He should know something about the bodily effect of materials, that there are methods by which the extent of the hazards may be evaluated, and to what extent these must be removed to make the environment safe. The efficient well-trained man should be able to do this, giving due consideration to a safety factor without necessarily resorting to methods which pull the whole of outdoors through his ventilating system.

If and when scholarships are provided for the study of industrial hygiene, it would be well if these scholarships could be for each of the groups mentioned—not only for the first two.

Discussion:

WARREN A. COOK: One of the control measures very interesting to me was the New York tunneling exhaust device. That was, I believe, something entirely new to most of us here, and though the picture did show to some extent what the machine looked like, it did not give a very clear view of where the exhaust was controlled. I wonder if we could have more information concerning that particular type of equipment?

MR. LAMENZO: You will remember that the picture showed the carriage which is capable of having mounted on it six drills of drifter type—two at the top, two at center, and two at the bottom. Along the top, there are two 10-inch ducts. Along the bottom there are two more 10-inch ducts converging at the rear to the 20-inch manifold, which is connected to a fan of special design (See No. 11). The top ducts are, I should say, about 18 inches from the point of operation. The bottom ducts are back a little bit farther than that—about 24 inches.

The method of control is very much different from the "drill-vac" which I also illustrated because it does not exhaust the dust immediately or at the time it is created. Dust is allowed to come out of the drill hole and then the change of air occasioned by the capacity of the fan takes care of reducing contamination. In the "drill-vac" we have local exhaust, and in this device we have its counterpart, general room ventilation.

DR. HAROLD GAY (Dow Chemical Company): Here is a question I have thrown at me by labor, and by men in my organization. They want to know why it is that ordinary road dust, which they feel is fine, can not produce silicosis, and why industry is being called upon to pay for so many cases of silicosis which may have arisen outside of industry. Can anyone give me an answer which will satisfy labor and the men who are handing out large sums of money for payment?

MR. LAMENZO: I think the answer to this question of Dr. Gay's was very ably handled by Dr. Schrenk when he said that the human system is capable of taking care of certain amounts of all poisons. It would seem that exposure to outside dust may show certain evidences of dust in an x-ray, but that it never could be considered a source of danger in so far as silicosis is concerned. In industry, however, the dust conditions are different. The concentrations are heavier. A man may be exposed to 75 or 100 million particles of dust during his entire working day if the operation is uncontrolled, whereas the outside air, from certain tests which have been made, may probably get up to six million, but I think it is around a million and a half or three million. I don't believe the exposure to outside dust can be compared to the exposure to dust within a plant.

DR. R. R. SAYERS: Dr. Gay's question has been partially answered, maybe entirely answered, in this: that a man does not get sufficient dosage over the period of time. It is the total dosage that apparently causes the disease of silicosis. Occasionally, some have had concentrations as high as we have in industry, but it isn't over a long enough time—such as months and years.

As to why industry has to pay the bill—we haven't, on

physical examination of literally thousands of people not exposed to industrial dust but to general dust in dry country, found silicosis existing in those groups. I believe that answers the question.

DR. R. W. COLINA (Michigan Department of Health): I would like to get the insurance company's viewpoint on portable hoods. What ideas have you on the type of hood that the workman can just throw aside when he is working with a tool as compared with the type that has to be moved around?

MR. LAMENZO: We place the portable hood in the same category as the respirator. The use of both requires the very best of supervision. The worker has to be told why he should wear the respirator; and the same holds true as to the use of the portable hood. The worker has to be taken into your confidence. He has to be told why the hood has been applied to the job and why he should always use it. If he fails to use it, then there is only one thing to do—put another man on the job who will use it.

In Vermont, in the quarry sheds where they have dozens of portable hoods, I found the workers tickled to death to use them. They wanted control measures installed. The portable hoods were the only kind that could be used in that industry, and I didn't see one man abuse the hood or fail to use it.

About the only thing I did see was the continued use of a practice of brushing the stone. Some workers, instead of brushing forward into the hood, carrying the hood along with them, would brush sideways, thus generating a lot of dust. The proper use of the portable hoods is a matter of education.

MR. W. A. TWINE (Zurich): I would like to ask Mr. Lamenzo to elaborate on whether it is advisable to install dust collecting systems in the same room with the workmen and to exhaust through a window?

MR. LAMENZO: I would say yes, but I would like to add that the installation of dust collecting equipment is not the answer to our problem. Once the equipment is installed, it must always be maintained in good operating condition. Your hoods and piping must be periodically inspected, and your dust collector must be examined for leaks. If the equipment is well designed and then well maintained I would say that it is perfectly all right to collect in the work room and exhaust to the outside air. I don't think you will find that the air exhausted will have any more, or very many more, particles per cubic foot of air than the air already existing out of doors.

MR. W. L. HANAU (New York): Where dust control equipment is installed, what method is used in determining the effectiveness of the control established? Is it a visual test, or are specifications written into the equipment order that certain control must be established?

MR. LAMENZO: As an insurance man, I would say that where you can see dust — and you are able to see it in many of the illustrations I showed you—if that visible dust is removed by the use of adequate exhaust ventilation, you can rest assured that a large percentage of the fines have also been taken out. The fines you can not see—the heavy particles you can see. However, in some establishments, they like to hold the ventilating engineer down to certain figures.

If a code exists calling for six million particles per cubic foot, or for 20, or 10, the purchaser of that equipment will insist that the ventilating firm make tests before and after. However, we are satisfied to depend entirely upon the ability of the ventilating engineer. If he knows what he is doing, and if he exhausts the material you can see, you can rest assured the fines are also out.

DR. C. W. WINSOR: I would like to ask Mr. Lamenzo how he determines the capacity of the exhaust equipment? In our plant, Parke Davis & Co., the units are small and our problem frequently is what amount of air shall we move? He mentioned, for example. in shaking down large castings. some 20 000 cubic feet of air per unit of time. How is that determined, and how can we tell the amount or rather the capacity of the exhaust equipment necessary in small units, largely for nuisance dust?

MR. LAMENZO: I think there are two points to bear in mind. First you have a dust hazard which you want controlled. Secondly, you want to know if the hazard has been controlled. In answer to the first point. the industrial ventilating engineer designs the equipment necessary to control the particular operation. He may tell you that this equipment is capable of exhausting so many thousand cubic feet of air per minute and he may also instruct you not to stick anything else on that system. Let us say it is for grinding wheels. You may have half a dozen of them. The system will take care of the six you already have, but it will not take care of two more that you may install. You must place dependence upon the ventilating engineer called in to do the job. In the first place, get a good man who knows his job and then follow his instructions. If you feel that your operation is going to expand, tell him so and he will build his unit large enough so that you can very easily add on to the existing system one or two additional units.

As to the second point, I don't think there is a satisfactory method that a plant engineer can use unless he wants to start in counting dust particles, and, for nuisance dusts this is not necessary. He can check up, if he wants to, on the efficiency of the exhaust in many ways, but I always like to depend on the man whose job it is to take out the dust—the industrial ventilation engineer. Have confidence in him and then feel satisfied that he has taken care of the job.

Engineering Aspects of Problems in Industrial Epidemiology

J. J. BLOOMFIELD,
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THE USE of the word *epidemiology* in a discussion generally raises the question of its meaning because, at present, there is no unanimity of opinion with respect to an acceptable standard definition. In some circles the term as normally used is confined to the investigation of the incidence of an infectious disease among a population of human beings, particularly when the disease has assumed a state of epidemicity. The late Dr. W. H. Frost, in discussing the entire subject in 1927,[1] stated that such a definition implies that the phenomena of epidemics are distinct from those of the interepidemic or endemic occurrence of disease, and though such a view may have been held in former days, more recently it was recognized that an epidemic is only a temporary phase in the occurrence of any disease, and that its phenomena, if viewed scientifically, must be related

to the antecedent and subsequent history of the disease. Late usage has extended the meaning of epidemiology beyond its original implications, so that it embraces a science of wide scope in relation to the mass-phenomena of any disease, whether such diseases occur in epidemic or in endemic form, among human beings or life of a lower form.

In view of the fact that epidemiology depends largely for its effective progress upon what has been accomplished in other fields of science, it may in its broader sense be defined as a collective science which presents a methodology for the investigation of any recognized disease in a group of living forms, and the subsequent determination of its prevention or control. Perhaps the first major step in epidemiological studies is the investigation of the association between the occurrence of the disease and some special condition or set of conditions. Such a step primarily involves a statistical process of ascertaining the frequency of the disease in contrasted groups of population with respect to the particular condition. In some instances, this association may be quite obvious so that no involved statistical analysis is required, whereas in other cases the differences between the contrasted groups may not be so evident. In the latter instance the final acceptance of a hypothesis believed to explain a situation is yielded only by the application of the principles of logic, including the theory of probability, to data of unquestioned reliability.

If we examine the literature of industrial hygiene, we are at once confronted with the fact that the methods employed in the study of the effect of industrial health hazards differ in no respect from those utilized in investigations of other phases of public health. This is not strange, since in the study of industrial diseases it is essential, as in communicable disease investigations, to determine the etiology, pathology, symptomatology, and the application of measures to prevent or control the disease.

In the light of the foregoing discussion, it may be considered appropriate to employ the term *industrial epidemiology* as implying the methods used for the investigation of diseases occurring in industry or among industrial workers and the subsequent determination of methods of prevention or control of such diseases.

One of the important procedures in the search for major factors in the causation of disease suspected to be of occupational origin is a detailed engineering study of the environmental conditions associated with employment. Such surveys are not only useful in determining the origin of the disease, but also serve to indicate the extent of the hazard, and quite often the measures which might be employable for its control. The present contribution is an attempt to illustrate the methods employed by the engineer in industrial epidemiology based on a study of the pneumonia problem in the steel industry conducted several years ago. This particular study was purposely selected because it illustrates clearly the role of the engineer in investigating problems in industrial epidemiology, and also because it emphasizes the need and value of the statistical approach to studies of industrial health hazards. It is felt that the methodology described in the present discussion can be applied with slight modifications to engineering studies of other industries and health hazards.

The Pneumonia Problem in the Steel Industry

THE Division of Industrial Hygiene of the United States Public Health Service has been receiving reports from industrial sick benefit organizations since 1922. A study of these reports from the steel industry indicated that iron and steel workers showed consistently higher incidence rates for pneumonia in all forms than employees of other industries. For the period 1922 to 1928, inclusive, the pneumonia case rate in the steel industry was nearly 70% above the rate in the reporting public utilities, and nearly 50% higher than all other reporting industries as a group. This fact is clearly illustrated in Table 1.

TABLE 1.

FREQUENCY OF CASES OF PNEUMONIA (ALL FORMS) CAUSING DISABILITY FOR EIGHT CALENDAR DAYS OR LONGER AMONG THE MALE MEMBERS OF SICK BENEFIT ASSOCIATIONS REPORTING TO THE UNITED STATES PUBLIC HEALTH SERVICE, 1922 TO 1928, CLASSIFIED ACCORDING TO INDUSTRY

Industry	Annual Number of Cases per 1000 Men (in terms of years of life observed)	Number of Cases of Pneumonia	Number of Years of Life Observed[1]
Iron and Steel	4.4	1,457	330,606
Public Utilities	2.6	521	202,822
Other Industries[2]	2.9	854	292,477

[1] Sum of the average number of members for each of the years included.
[2] A miscellaneous group: products include chemicals, abrasives, plumbing fixtures, electrical equipment, paper, paper novelties, timepieces, hats, underwear, flour, soap, and other articles of manufacture. During the five years 1924-1928, the pneumonia rate for this group was 3.0.

Among industrial workers one may expect an average pneumonia incidence rate of 2.5 to 3.0 cases per year per 1,000 men; in steel, the average rate in the period mentioned was 4.4 cases annually per 1,000 male members of the reporting sick benefit organizations. This result is more striking on account of low morbidity rates for nearly all of the major causes of illness among steel workers, which is suggestive of a favorable position of these men from a physical standpoint.

The average pneumonia rate for all reporting companies, except those in the steel industry, in the period 1922 to 1928, inclusive, was 2.8 cases annually per 1,000 men, which rate subtracted from 4.4 for the steel industry, gives an excess incidence for the latter of 1.6 cases annually per 1,000 men. If this excess pneumonia incidence rate of 1.6 cases per year per 1,000 men is applied to the number employed in blast furnaces, steel works and rolling mills, the estimated yearly excess of sickness from this cause is found to be 685 cases. Assuming that only 25% of the men attacked by pneumonia will die from it (the percentage was 31 in a large steel works studied), one finds an excess of 171 deaths from pneumonia annually in the industry. It is evident that merely from the standpoint of lives lost, there are very

few problems in industrial hygiene which merit more urgent attention. *It is desired to stress the fact that it was through the agency of recording absenteeism due to illness among steel workers that our attention was first called to this excessive pneumonia incidence among them. In the absence of such information it would have been difficult to estimate the relative importance of sickness problems in need of attention.*

in the community. Without going into great detail concerning these various factors, it is sufficient to say that our studies showed that an excessive amount of pneumonia still existed among the steel workers even after due allowances had been made for these factors.

The data furnished by one of the steel companies permitted a tabulation of the cases by certain departments. Table 2 shows the frequency of pneu-

TABLE 2.

FREQUENCY OF SPECIFIED RESPIRATORY DISEASES BY DEPARTMENTS OF A STEEL PLANT, 1924-1928 INCLUSIVE. MALE CASES CAUSING DISABILITY FOR MORE THAN ONE WEEK

Departments	All Respiratory Diseases[3]	Pneumonia	Influenza and Grippe	Bronchitis	Asthma	Diseases of the Tonsils	Tuberculosis	Other Respiratory Diseases
	Annual Number of Cases per 1,000 Men							
All departments	42.6	6.1	22.1	3.0	2.2	4.5	2.0	2.7
Blast furnace	59.4	14.0	34.5	*	*	*	*	*
General to mills[1]	66.0	10.8	35.6	4.8	*	5.6	*	4.3
Coke ovens	46.8	10.7	21.1	*	*	*	*	*
Open hearth	65.5	8.5	33.2	6.5	*	6.5	*	*
Rod and wire mills	42.7	7.4	22.8	*	*	*	*	*
Shops[2]	49.8	5.9	26.0	3.3	*	4.7	3.3	3.9
Coal mines	52.3	5.2	28.5	3.1	4.4	5.1	2.8	3.2
Railroad	36.5	*	24.3	*	*	*	*	*
Office	21.0	*	*	*	*	*	*	*
All other departments	28.5	3.8	13.7	2.0	1.3	4.3	1.3	2.1

[1] Including general to open hearth mills and general labor department.
[2] Steel car, plumbing, boiler, roll, and disc shops.
[3] Including 51 pneumonia cases which died prior to the eighth day of disability.
* Not computed when number of cases causing disability for more than one week was less than 20.

Since certain factors apart from the nature of the work and the working environment may affect the frequency of pneumonia, the more important of these required measurement and evaluation before considering other logical steps. Among such factors may be listed seasonal variation in frequency of the disease, influenza epidemics, age of the men, their nationality, extent of addiction to alcoholic stimulants, and prevalence of pneumonia

monia, as well as other specified respiratory diseases, by departments in this steel plant for the period 1924 to 1928, inclusive, for cases causing disability for more than one week. It is evident that there existed an abnormal frequency of pneumonia in certain departments. The rates were unusually high in the blast furnace, coke ovens, open hearth, rod and wire mills, and in "general to mills." Among men employed in the shops (steel

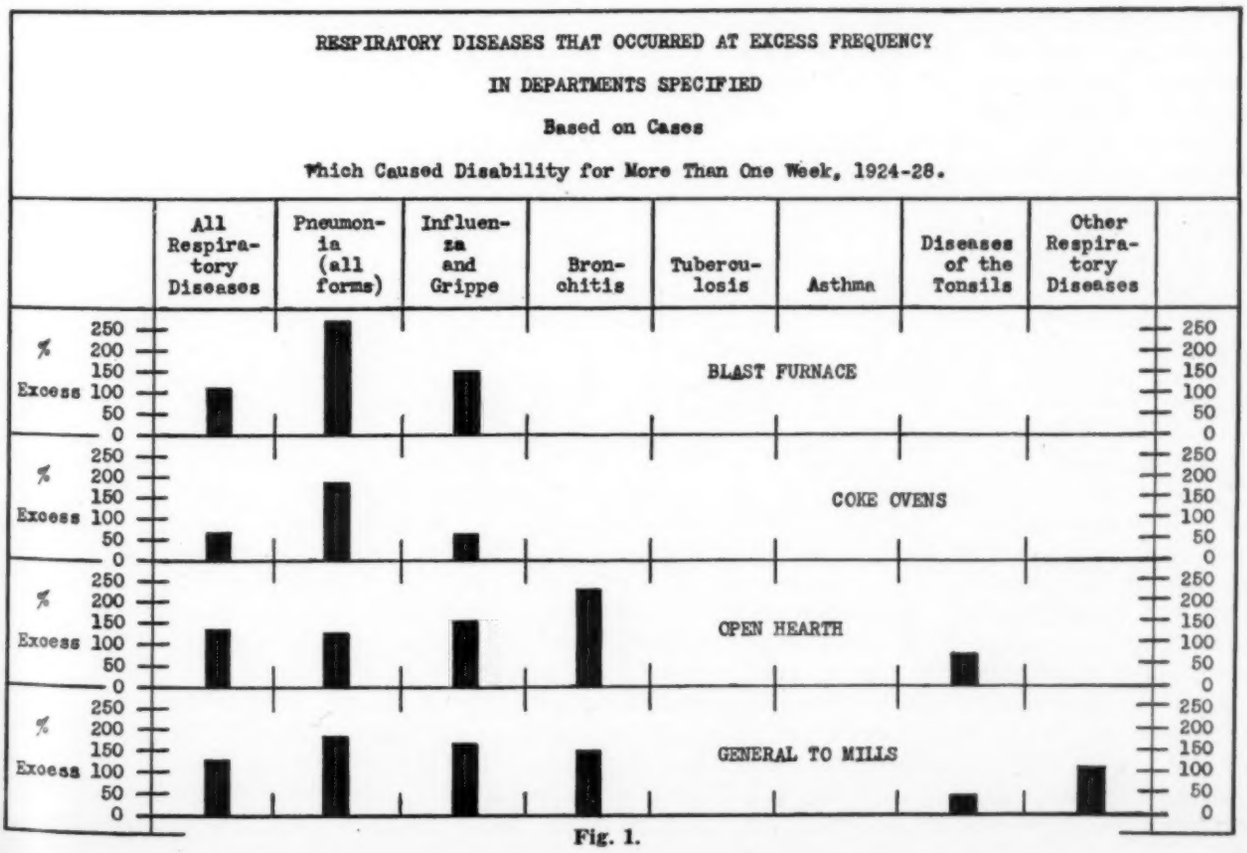

Fig. 1.

car, plumbing, boiler, roll, and disc), and in the coal mines, the pneumonia rates exceeded the average for industrial workers, although not so markedly as in the other departments named. In each of these departments the frequency of influenza or grippe was definitely above the incidence recorded for all other departments as a group. Fig. 1 illustrates the percentage excess of pneumonia and other respiratory diseases in each department over "all other departments." For example, pneumonia among blast furnace workers is shown to be 268% higher than the frequency of this disease among workers in "all other departments."

The statistical analysis of the pneumonia problem among steel workers briefly outlined herein clearly indicated that the nature of the work and the working environment probably played an important role in the causation of this disease. The pneumonia rates found in this industry constituted the basis for a detailed study of working conditions which might predispose to pneumonia or to certain other respiratory diseases. It is in such detailed studies of the working environment that the industrial hygiene engineer plays an active part. In this particular inquiry both medical and engineering studies served to clarify the problem and indicate measures which might be employed for its solution. The present discussion, however, is limited to the engineering phases of the study.

Method of Study

THE preliminary statistical findings indicated that the highest frequency rates for pneumonia occurred among individuals employed in five important departments of the plant under consideration—namely, the coal mines, coke plant, blast furnace, open hearth and general labor departments. Hence, the engineering environmental studies were confined to these departments and one other—the open hearth steel finishing mills—the latter being included for control purposes. At the time of this inquiry, these six departments employed slightly more than 5,000 men, or about 42% of the total number working in the entire plant.

First, a study was made of the various manufacturing processes involved in each department, and this was followed by a detailed study of each individual occupation. This preliminary occupational analysis formed the basis for the remainder of the investigation, since it yielded information concerning the number of persons, the activities involved, and the particular exposure associated with each occupation.

This preliminary analysis showed that there were five exposures in the departments which could be considered of significance as causative factors in pneumonia. These exposures were: heat with wide changes in temperature; strenuous work; outdoor work in all kinds of weather; gases and smoke, and dust. One example of a study of the nature of the industrial exposure involved in a department in the steel industry should suffice to indicate the relationship which was found between the frequency of pneumonia and these environmental exposures by occupation.

Table 3 shows the occupational analysis and exposure of blast furnace employees with the number of pneumonia cases, and the number of employees in each occupation. Among the 570 men employed in the blast furnace department, there occurred 26 cases of pneumonia for the years 1924 to 1927, inclusive. The concentration of the excess cases in a relatively few occupations is strikingly shown in Table 3. For example, 11 of the 26 cases of pneumonia occurred among five occupations in the casting section. It will be noted from a study of this table that the employees in this section were exposed to a considerable degree to all of the five conditions which may be causative factors in pneumonia. Extent of exposure was recorded in one of three catagories, namely, no exposure (0), slight or occasional exposure (*), and heavy exposure (**). Of the 68 different occupations in the blast furnace department, pneumonia was confined to only 10. This finding simplified the environmental studies which followed. In this connection, it is desired to point out the fact that in the general mechanical section of this department, where certain occupations were recorded as having slight or heavy exposure to the five conditions noted in the table, the workers have only occasional or intermittent exposure to the listed conditions. Table 3 brings out one very important point which requires emphasis. The abnormally high incidence of pneumonia for certain occupations might not have been noted for years if the number of cases occurring in the group had not been related to the population exposed, as shown in Table 3. When such sickness rates are available for specific diseases by occupation, the effect on health of certain environmental conditions becomes susceptible to study. Such data also enable one to judge the effectiveness of control methods for diseases occurring in excessive frequency.

Table 4 presents the frequency of pneumonia according to occupation and in relation to the nature of the industrial exposure involved in the blast furnace department. In view of the fact that pneumonia was confined to very few of the occupations in this department, Table 4 condenses the findings shown in Table 3 and, in addition, presents pneumonia rates per 1,000 men, and also shows the actual number of cases of pneumonia in contrast to the number expected, which may be computed from the rate per 1,000 men in "all other departments," previously shown in Table 2.

Prior to discussing the implications of the data in Table 4, it may be briefly stated that the only exposures which it was possible to evaluate quantitatively were gases, dust, and heat with wide changes in temperature. The gases studied in the steel mill were found to be carbon monoxide, hydrogen sulphide and sulphur dioxide, and these were determined by standard chemical procedure employed in gas analysis.[2,3,4] Dust studies were made by the technic employed by the Public Health Service.[5] Exposure to radiation was determined by a calibrated radiometer, and the skin temperature of the workers involved was

used as an index of the possible physiological effect of the heat exposure on the human body.[6] Certain other environmental factors, such as temperature, humidity, and air movement of the workrooms were also noted.

The stacks and stoves (casting section) are concerned with the making of pig iron, and the maintenance of the machinery in connection with the operation of the blast furnace. The cast-house keepers and helpers were observed as being exposed to heat with extreme variations in temperature, to gases and smoke, and, to some extent, to dust, and to inclement weather. The work is strenuous. When the molten iron flows down the trough to the ladles, these men are exposed to radiant energy of about 2.57 gram calories per square centimeter per minute. This intensity is severe enough to cause profuse sweating in a few

TABLE 3.

OCCUPATIONAL ANALYSIS AND EXPOSURE OF BLAST FURNACE EMPLOYEES WITH THE NUMBER OF PNEUMONIA CASES ASSOCIATED WITH EACH OCCUPATION AND THE NUMBER OF EMPLOYEES IN EACH OCCUPATION

Department and Occupation	Kind of Exposure: Heat with wide changes in temperature	Gases and Smoke	Strenuous work	Dust	Outdoor work in all kinds of weather	Number of pneumonia cases for the years 1924–1927, inclusive	Population
General							
Asst. superintendent	—	—	—	—	—	—	3
General foreman	—	—	—	—	—	—	2
Turn foreman	—	—	—	—	—	—	6
Metallurgical asst.	—	—	—	—	—	—	2
Clerk	—	—	—	—	—	—	4
Janitor	—	—	—	—	—	—	2
General labor							
General labor foreman	—	—	—	—	*	—	2
Labor foreman	—	—	—	—	*	—	4
Gang leader	—	—	—	—	**	—	1
Laborer	—	—	—	—	**	6	61
Car dumper							
Operator	—	—	—	—	—	—	10
Oiler	—	—	—	—	*	—	2
Car cleaner	—	—	—	—	*	—	14
Laborer	—	—	—	—	**	5	15
Transfer cars							
Transfer car man	—	—	—	—	—	—	4
Transfer car man coke	—	—	—	**	—	1	2
Ore bridges							
General foreman	—	—	—	—	*	—	2
Ore yard foreman	—	—	—	—	*	—	8
Ore bridge operator	—	—	—	—	—	—	8
Oiler	—	—	—	—	**	—	4
Trestles and bins							
Laborer	—	—	—	—	*	—	3
Stock unloader	—	—	—	—	*	—	32
All stacks and stoves (charging)							
Stock house foreman	—	—	—	—	—	—	12
Larryman	—	—	—	*	*	1	63
Skipman	—	—	—	*	*	2	24
Oiler	—	—	—	*	*	—	3
Stacks and stoves (casting)							
Blower	*	*	—	—	*	—	12
Keeper	**	**	**	*	*	1	24
1st helper	**	**	**	*	*	3	24
2nd helper	**	**	**	*	*	4	33
Hot blast man	*	**	*	*	**	2	24
Stove cleaner	*	**	*	**	**	1	7
Blowing engines (steam driven)							
Chief engineer	—	—	—	—	—	—	2
Engineer	—	—	—	—	—	—	12
Engineer asst.	—	—	—	—	—	—	12
Oiler	—	—	—	—	—	—	7
Laborer	—	—	—	—	—	—	2
Blowing engines (steam driven) (repairs)							
Repairman, 1st class	—	—	—	—	—	—	2
Repairman, 2nd class	—	—	—	—	—	—	2
Repairman, 3rd class	—	—	—	—	—	—	1
Repairman helpers	—	—	—	—	—	—	2
Ladle house (inc. hot mtl. cars)							
Ladle liner	*	*	—	—	*	—	3
Ladle liner helper	*	*	—	—	*	—	2
Casting machine							
Foreman	*	*	—	—	*	—	6
Pourer	**	*	—	—	*	—	6
Troughman	—	—	—	—	—	—	6
Conveyorman	*	—	—	—	*	—	6
Craneman	—	—	—	—	—	—	3
Laborer	—	—	—	—	*	—	1
General mechanical[1]							
Master mechanic	—	—	—	—	—	—	2
Clerk	—	—	—	—	—	—	2
Repair foreman	—	—	—	—	—	—	2
Turn repair foreman	—	—	—	—	—	—	6
Repairman, hot stoves	**	**	*	*	**	—	5
Repairman, 1st class	**	**	*	*	**	—	7
Repairman, 2nd class	**	**	*	*	**	—	1
Repairman, 3rd class	**	**	*	*	**	—	2
Repairman, 1st class	—	*	—	—	*	—	6
Repairman, ore yard	—	—	—	—	—	**	3
Repairman, 2nd class	*	*	—	*	*	—	5
Repairman, 3rd class	*	*	—	*	*	—	1
Repairman, 4th class	*	*	—	*	*	—	1
Repairman, 5th class	*	*	—	*	*	—	3
Repairman helper	*	*	—	*	*	—	15
Blacksmith and helper	*	*	—	*	—	—	3
Pipe fitter	*	*	—	*	*	—	9
Scaleman	—	—	—	**	*	—	2
Water station							
Pumpman	—	—	—	—	—	—	3
						26 cases	570

Repairs on hot stoves only

[1] Occupations in this department have only occasional and intermittent exposure to conditions listed.

minutes, even under intermittent exposure and under winter conditions. A conception of the meaning of the magnitude of 2.57 gram calories per square centimeter per minute may be obtained when it is stated as the equivalent of the radiation from 128 Mazda C lamps (200 watts each) at a distance of three feet. This group experienced 13 times as many pneumonia cases as were to be expected from the rate of the control group in the plant. The other occupations of the casting section, i.e., blowers, hot blast men, and stove cleaners, involve less exposure to extreme changes in temperature. Their pneumonia rate was only four times the frequency experienced by the "all other departments" group.

The general labor section serves as a clean-up force around the yard, and the work of the laborers in the car dumper section consisted of handling the incoming materials such as limestone, coke, iron ore, baked flue dust, and open hearth cinders. The work was all performed out-of-doors, and was continued regardless of the state of the weather. In this section the only working condition which appeared to involve a potential hazard from a pneumonia standpoint was continuance of outdoor work during storms and other periods of inclement weather. Pneumonia occurred in this group at about seven times the expected frequency. Similar findings in the other departments experiencing high pneumonia rates suggested that the environmental factors noted played an important role in the causation of this disease.

TABLE 4.

FREQUENCY OF PNEUMONIA ACCORDING TO OCCUPATION, AND IN RELATION TO THE NATURE OF INDUSTRIAL EXPOSURE INVOLVED IN THE BLAST FURNACE DEPARTMENT, 1924-1928

Sections and Occupations	Nature and Extent of Occupational Exposure (1)					Annual Number of Cases of Pneumonia per 1000 men	Number of Cases of Pneumonia		Approximate Number of Years of Life Observed
	Heat with wide changes in temperature	Strenuous work	Outdoor work in all kinds of weather	Gases and smoke	Dust		Actual	Expected (2)	
All sections	—	—	—	—	—	14.0	36	10	2,578
Stacks and stoves (casting section)	—	—	—	—	—	27.2	17	2	624
Keepers	**	**	*	**	*	8.3	1	0	120
First and second helpers	**	**	*	**	*	41.5	12	1	289
Blowers	*	O	*	*	O	O	O	O	52
Hot blast men	*	*	**	**	*	16.7	2	1	120
Stove cleaners	*	*	**	**	**	46.5	2	O	43
General labor section and car dumper laborers	O	O	**	O	O	30.7	15	2	489
All other sections[3]	*	*	*	*	*	2.7	4	6	1,465

[1] Symbols in exposure:
O, no exposure;
*, slight or occasional exposure,
**, heavy exposure.
[2] Number expected from the rate per 1,000 men in "all other departments" in Table 2.
[3] Eight percent of the men heavily exposed, 23%, slightly or occasionally exposed to heat with wide temperature changes. To strenuous work, no one was heavily exposed, and only 5% had occasionally to work strenuously. To outdoor work in all kinds of weather, about 8% of the men were heavily exposed, 80% slightly or occasionally exposed. To gases and smoke about 5% were heavily, and 25% slightly or occasionally exposed. About 1% of the men were heavily exposed to dust, and about 55% slightly or occasionally exposed.

Incidence of Pneumonia According to Kind of Industrial Exposure

CERTAIN occupations in the steel industry have been shown to be associated with an unusual frequency of pneumonia; there remain to be evaluated the kinds of industrial exposure which may constitute pneumonia hazards. Table 5 is an attempt to show the frequency of pneumonia according to the nature of exposure.

A major difficulty in attempting such an appraisal arises from the fact that a very small number of men were subjected to just one condition mentioned without significant degrees of other kinds of industrial exposure. One could not obtain a reliable pneumonia incidence rate for persons exposed only to gases and smoke, to dust alone, and to strenuous labor without other complicating deleterious conditions. The rate could be computed, however, for men obliged to work out-of-doors during inclement weather, and for those subjected to heat with wide changes in temperature without significant exposure to any other kind of industrial health hazard. The frequency of pneumonia in these two groups was 13.6 and 12.6, respectively, in contrast with a rate of 3.9 cases annually per 1,000 exposed to none of the working conditions under scrutiny. The exposed groups include men slightly or occasionally, as well as those heavily exposed, because considerable allowance should be made for the variation in the reaction of different individuals to their working conditions. A somewhat lower rate, 10.6, was found among those exposed to one or more of the conditions under study, but exclusive of exposure only to inclement weather and only to a heat hazard.

TABLE 5.

FREQUENCY OF PNEUMONIA ACCORDING TO NATURE OF EXPOSURE IN A STEEL PLANT, 1924-1928[1]

Industrial Exposure to:[2]	Annual Number of cases of pneumonia per 1000 men	Number of cases of pneumonia	Approximate number of years of life observed
One or more conditions[3]	12.1	186	15,399
None of these conditions[3]	3.9	14	3,616
Inclement weather only	13.6	88	6,482
Heat with wide changes in temperature (no other hazard)	12.6	20	1,587
Other conditions[4]	10.6	78	7,330

[1] Employees of the mines omitted as well as those in departments in which no observations were made.
[2] Includes slight or occasional as well as heavy exposure.
[3] Conditions are: outdoor work in all kinds of weather, exposure to heat with wide changes in temperature, strenuous labor, dust, gases and smoke.
[4] Exposure to one or more of the conditions named in footnote 3, but exclusive of exposure only to inclement weather, and only to heat with wide changes in temperature.

Recommendations

AS THE result of the study conducted in one of the steel plants, several remedial measures suggested themselves and are presented herewith for consideration:

1. Mechanical devices to reduce the effective temperature in occupations involving exposure to radiant energy.[7]

2. Extension of the mechanization of processes involving heat hazards will doubtless tend to reduce the frequency and intensity of the workers' exposure.

3. Adequate provision for change houses for employees exposed to the conditions which appear to predispose to respiratory diseases, and compulsory use of such houses are indicated. Men perspiring freely after a bout of heavy work in front of the open hearth furnaces were observed changing clothes while standing in a direct draft; others went home without changing their clothes, even though they had become wet from perspiration.

4. Shelters appear to be needed in stormy weather by those who work out-of-doors.

5. Reduction of hours of work through the stagger system or some other plan, and the prohibition of double shift duty, especially during the winter months, in pneumonia-hazardous occupations would doubtless prevent the development of a number of cases of the disease.

6. In line with the development of education in industrial safety as conducted by the steel industry, furtherance of health education of employees appears to be an important weapon in combating pneumonia. Employees should be instructed as to the danger of sudden chilling due to comparative inactivity following exposure to high temperatures, and the importance of suitable protective clothing.

7. A visiting nurse service functioning preferably as part of the employee sick-benefit organization to instruct the patient and help arrange for adequate medical and nursing care while pneumonia (or any other disease) is still in its incipiency should reduce mortality and shorten the duration of non-fatal cases.

8. The effectiveness of measures taken to diminish the incidence of pneumonia should be gauged by means of sickness and mortality rates covering, preferably, a five-year period, and so tabulated as to reveal the effect of influenza epidemics that may have occurred in the period under review.

Summary

IN THE present discussion attention is called to the fact that recent practice in the field of public health has recognized that epidemiology goes beyond the study of infectious diseases, but also includes the methods employed for the investigation of any recognized disease and the subsequent determination of its control or prevention. The diseases which are experienced by industrial workers should be considered and studied in the same light employed for other diseases, and for this reason the term "industrial epidemiology" in the present discussion implies the methods used for the investigation of diseases occurring among industrial workers and the subsequent determination of their control or prevention. Since one of the important procedures in the search for major factors in the causation of disease suspected to be of occupational origin is a detailed engineering study of the occupational environment, methods are presented to illustrate the engineering aspects of problems in industrial epidemiological studies. The present inquiry was initiated as the result of reports from a group of industrial sick benefit organizations to the United States Public Health Service, which consistently showed a higher incidence rate of pneumonia among employees in the iron and steel industry than in other industries as a whole. Factors apart from working conditions, such as seasonal variation in the frequency of pneumonia, influenza epidemics, economic status of the workers, their age, nationality, extent of addiction to alcoholic stimulants, and the prevalence of the disease in the community selected for study of the pneumonia problem, were analyzed and found of insufficient influence to account for the high rate among the steel workers. A tabulation of the cases also showed an abnormal frequency of pneumonia in certain departments. These rates, therefore, constituted the basis for a detailed study of working conditions in the mills by industrial hygiene engineering methods, in order to learn which conditions might predispose to pneumonia and to certain other diseases of the respiratory system. This engineering study showed, among other things, that the disease was associated with exposure to heat hazards when subjection to wide changes in temperature was involved; also with outdoor exposure to inclement weather, and with indoor exposure to humid, drafty conditions and wet clothing. Sudden cooling or chilling of the body was indicated as an important predisposing factor. One of the interesting findings of this study was the concentration of the excess cases in a relatively few occupations. In the case of the blast furnace department, high pneumonia rates were limited to 10 of the 68 occupations in this department. This finding not only simplified the environmental studies, but also made a study of the control measures less difficult. There is no reason to believe that the methodology described in the present discussion cannot be applied with slight modifications to studies of other health hazards in industry.

In closing, it is desired to emphasize the fact that quite often an abnormally high incidence of disease for certain occupations might be overlooked for years, if the number of cases occurring in an occupational group is not related to the population exposed. When such sickness rates are available for specific diseases by occupation, the effect on health of certain environmental conditions becomes susceptible to study.

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Discussion:

JOHN M. HEPLER, C. E., Director, Bureau of Industrial Hygiene, Michigan Department of Health, Lansing, Michigan: When I was requested to discuss Mr. Bloomfield's paper to be presented at this conference, I felt that that honor would involve nothing more than complimenting Mr. Bloomfield on a presentation of outstanding character to which might be added a few platitudes and possibly a bouquet or two for the gentlemen who have so generously given of their time to make this Midwest Conference "the greatest show of its kind ever to be presented."

But upon receiving the copy of Mr. Bloomfield's paper, I found that here was something that needed entirely different treatment from that which I have outlined above. That the thought should have been presented by one who has had long experience in investigating industrial conditions for the whys and the wherefores is only natural, and that it should be presented at this time to this group is most apt and timely.

I am sure that many of us have sensed in the past year a different trend in industrial hygiene. More and more in the past 12 months we have heard emphasized the necessity of thinking of industrial medicine and industrial hygiene in terms of public health. This line of thinking was definitely established by Dr. M. N. Newquist in the report on "Medical Service in Industry and Workmen's Compensation Laws" recently published by the American College of Surgeons. When we find in that report that occupational disease accounts for only 0.01 day lost per employee per year and industrial injury 0.59 day lost per employee per year, whereas non-industrial injury and illness accounts for 8.85 days lost per employee per year, we immediately realize that we cannot justify the maintenance of medical departments and divisions of industrial hygiene merely to reduce the loss of the 0.01 day and the 0.59 day per employee per year. To do a real job of industrial hygiene we must think in terms of public health and in terms of those illnesses which do not appear on schedules as compensable but which are costing the employer many dollars in absenteeism and labor turnover. Diseases of the respiratory system and the digestive system need more attention paid to them, and with respiratory diseases representing 41.8% of the total incidence of diseases, our attention must be immediately directed to the respiratory diseases as deserving first attention. Mr. Bloomfield has well indicated in his paper some of the facts which can be developed if we will think in terms of those respiratory diseases and in terms of public health rather than occupational disease. His paper prompts me to relate briefly a somewhat similar study which I had the pleasure of making in Michigan.

About three years ago the management of a large iron foundry requested the services of the Michigan Department of Health to study the high incidence of pneumonia in one of their plants. During the previous winter they had had an unusually large number of cases of lobar pneumonia accompanied by a high mortality rate. Gossip had picked up the facts and, as gossip always does, had multiplied and enlarged them to the point that it was causing embarrassment to the personnel department.

Perhaps the long association with the State Health Department and earlier work with the Division of Engineering in investigating outbreaks of water-borne typhoid fever, and the fact that this was a study dealing with pneumonia, directed the approach, but it was approached as an epidemiological study. At the very beginning we set up a schedule of facts to be obtained. They included comparisons of physical conditions between plants, comparisons between departments and occupations, between males and females, and between white and colored employees, and comparisons by age groups, by length of service, and by total service in the foundry industry. In order to have a control the study was made to include both plants over two consecutive years, the one year in which the management was interested and the preceding year when no unusual conditions had prevailed.

Unfortunately, like most companies they did not keep sickness records. They had a sick benefit association and members of the association employed more than 30 days could apply for aid after a week of illness. Check stubs bearing the employee's name, clock number and cause of sickness for which the benefit was paid supplied the first source of information. Disregarding benefits paid for injuries and diseases other than respiratory, it was found that in the first of the two years studied, 106 benefits had been paid for sickness disguised as pneumonia, influenza, bronchitis, tonsillitis, pleurisy, asthma, etc. During that period the average number of men employed was 1,639, and so benefits represented one case per 16.4 employees. In the next year 277 benefits were paid for similar claims while the average number of employees was 2,279, a ratio of one case per 8.2 employees.

The data obtained from check stubs were segregated according to plants and according to cause. Under cause, three groupings were made: namely, pneumonia, influenza, and other respiratory cases. Influenza was set up separately to determine if an influenzal epidemic might be a causative factor. Pneumonia deaths in the plant were compared with pneumonia deaths in the city and in the county in which the plants are located. As all pneumonia deaths were among male workers, all city and county deaths, females, and males under 20 and over 65 were disregarded in these comparisons. The net outcome of these studies indicated definitely that some adverse condition existed in the cleaning and inspection department of the one plant.

Sick benefits did not provide sufficient information to answer other questions which the study created. Frequently employees died before the required 30 days of employment were completed. Sometimes sick benefits credited the man with three or four diseases during the period of benefit payment. Accordingly the visiting nurse was provided with case history forms and instructed to obtain a complete history for all of the 277 employees receiving benefits for respiratory diseases who were still employed. For a control a similar number of histories on "not-sick" employees by departments and race in the same ratio as the sick ones was requested.

From these case histories it was possible to obtain data on personal habits, such as dress, use of showers and home sanitation. Similarly, data on height, weight and age of the groups became comparable. Seasonal incidence, direction of wind, temperatures and other physical and meteorological data were studied. But again, all results pointed directly to something unusual in the cleaning and inspection department of the one plant.

Morbidity and mortality rates per 1000 of white and colored employees in the various departments of the plant showed that the pneumonia attack rate was higher in the molding and cleaning and inspection departments than in any other department of the plant. The incidence was higher among "shake-out" men and "chip and pull wire" men than any other employees in those departments. The pneumonia attack rate was uniformly higher in colored men than in white men at the same occupations. The

attack rate was two and one-half times as great among white men in cleaning and inspection as compared to white men in the molding department. The attack rate was higher for men with less than six months service as compared with men of longer service.

Influenza on the other hand did not increase in relation to pneumonia incidence; nor was the influenza incidence any different in the two plants of the company; nor was the incidence any higher among new men.

Height, weight, age, home sanitation, shower and dress habits and nature of previous employment furnished no evidence as influencing factors.

As a result of this study certain recommendations were made to the management and it was agreed to carry the study through another winter. The service of the visiting nurse was continued, and every possible arrangement was made to obtain complete histories on every respiratory cases that lost more than two days' employment.

From this, 369 case histories were available for the study of the third winter as compared with 308 sick benefit records. Payroll breakdowns, individual records of hires, transfers and releases, and records of length of service were obtained.

By analysis of the data in a manner similar to that used the preceding years, we now have the incidence and mortality rates for pneumonia over a period of three winters, one of which might be termed normal to that section of Michigan, one a severe winter, and one commonly designated as a mild winter.

We have determined a probable morbidity and mortality rate for pneumonia, influenza and other respiratory diseases in the molding, core, and cleaning and inspection departments of this foundry. We can now state definitely that the high incidence and fatality rate for pneumonia was due to an unusual condition in one part of the plant. Alterations in plant layout and ventilation completely eliminated the chip and pull wire employees from the "extra-hazardous" occupation of the cleaning and inspection department and lowered the incidence rate to a figure less than is to be expected in the moulding department.

All through this study the lack of comparable data from the foundry industry as a whole, or for a group of foundries in the North Central part of the United States or for line production foundries as compared to bench and floor molding foundries presented a serious handicap. After obtaining incidence and mortality rates we had nothing to compare them with. Rates for the iron and steel workers as given in "Frequency of Pneumonia Among Iron and Steel Workers," U. S. Public Health Service Bulletin No. 202 were hardly comparable. Neither could we reconcile our rates for a line production foundry with rates as published quarterly in U. S. Public Health Service Reports for the iron and steel industry. Only recently through the kindness of Dr. R. R. Sayers and Dr. W. M. Gafafer, of the Division of Industrial Hygiene of the U. S. Public Health Service, did we obtain rates on a group of foundries located in the northern industrial area. Although the rates for pneumonia in the foundry under study are higher than those received through Dr. Sayers, they are of the same general order, and we feel that we have proved the following important facts: namely (1) that pneumonia must be accepted as a definite occupational hazard in a line production foundry; (2) that the incidence will be greater in the molding department than in any other department; (3) that shake-out men are the most susceptible, due to the greater dust and extremes of heat exposures; and (4) when rates greater than those for molders occur in other departments or occupations, some unusual condition, capable of rectification, is possible.

But none of these facts can be determined unless sickness records are kept, and no records will be of much value unless methods commonly used by the epidemiologist are applied.

To that end I feel that we owe sincere thanks to Mr. Bloomfield for calling our attention today to the obvious necessity of our thinking not only in the broad terms of public health but more especially in terms of industrial epidemiology.

Industrial Hygiene and the Nurse

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FOR MORE than 40 years employers have, to a certain extent, availed themselves of the services of graduate nurses for the care of workers in their homes, as a means of expressing their benevolent and charitable natures. The enactment of labor legislation and the passing of the compensation laws in Wisconsin beginning in 1911, forced recognition of the broader economic necessity for preventing accidents and conserving life, after which nurses were employed to a greater extent. Their chief duties were to dress minor injuries and so prevent infections, and give first aid to serious cases pending the arrival of the physician.

Industrial nurses are public health nurses who have acquired special training in organization and aid in the supervision of the health of those in industrial occupations. At the present time it is estimated that there are about 2,500 industrial nurses in the United States. However, this seems a very conservative estimate.

The field of the industrial nurse will vary with the industry and with the community. She serves such industries as manufacturing plants, mines, stores, restaurants, banks, and, in more recent years, railroads and airways.

The nurse frequently paves the way for the industrial physician in these various industries by proving that it is an economy to provide an adequate medical department. This has not been difficult in the larger industries, but when we consider that 98% of all plants throughout the country employ less than 500 workers, we must give attention to that vast number of individuals who go to make up our industrial communities.

To know the position of the nurse in industrial hygiene it is important to have a clear understanding of what we consider hygiene in industry. The science of the prevention and control of disease involving medical and engineering procedure, seems to be a fitting description.

The nurse because of her close contact with the employee assumes an important part in plant hygiene. This contact if established and cultivated through a keen interest, and through understanding of her opportunities as a teacher, may be the

means of influencing the worker in positive health habits.

Findings from a study made by the American College of Surgeons report 15 times as much time lost from non-industrial injuries and illnesses as from industrial injuries. The Metropolitan Life Insurance Company reveals that 2% of workers are incapacitated all the time on account of illness.

Employers cannot cope with the employee health problem alone. There must be cooperative attitude on the part of employers, physicians, laboratory workers, engineers, nurses, and the workers themselves. Results will be obtained in comparison to the effort put forth.

FAR-SIGHTED management of small plants will seek medical advice regarding the establishment of health programs. If these programs are to serve the ultimate need of small industries, organized medical service may well find a way to relieve the present haphazard methods. You physicians and surgeons who know the industrial field, who have a broad knowledge of the lack of scientific health work in many small industries, must pass on to the employer the information which will interest him in establishing and furthering this health program. Employers of labor are as a group, civic minded men. They are interested in the welfare of their employees, and in the welfare of their communities. Workers in industry go to make up a great part of the national population, and upon their health depends the industrial welfare of the nation. Legislation or laws cannot take the place of the interest and enthusiasm which comes from knowledge and the desire to do because of sincere interest and regard for one's fellow man.

The nurse with her knowledge of public health, which should include a knowledge of community resources, and of mental and industrial hygiene, serves as an invaluable aide to the physician on this important program. In any event, the scientific principles underlying cleanliness, ventilation, lighting, and plant arrangement of working equipment should be sufficiently understood by the nurse, so that she can interpret their value to the employee. To do this intelligently, she must have a knowledge of the product manufactured and must know the materials which go to make up that product. This necessitates an inquiring mind and one which is ever open to current information on new processes of manufacturing. Because of the progress made in the chemical field, new health hazards are constantly occurring.

In large plants the nurse becomes the assistant and right hand of the doctor in the dispensary. Her work as a hygienist is then limited to educational activities, which she performs as a teacher —observing the patient while his injuries are being attended, carrying out the doctor's orders, encouraging the worker by complimenting him on some quality before suggesting or reprimanding. The nurse is frequently the employee's first contact with the medical department, and whether he feels kindly toward the department depends in a great measure upon her understanding and tactful approach.

By far the greater number of industries have no one physician serving, but must depend upon a selection from physicians designated by the industry or the insurance carrier. It is in these plants that the nurse takes on the most important role.

Unfortunately, the physicians or surgeons from this group seldom, if ever, see the industrial plants and know the true conditions of the worker's environment and manufacturing hazards involved. It is essential, therefore, that the nurse be able to translate to the physician the complaints of the worker which pertain to illness or injury.

IN ORDER that the employee may be placed on the job for which he is physically and mentally fitted, there must be a physical examination program. Pre-employment examination alone is not adequate for the maintenance of this program. It is essential that there be a periodic follow-up, the frequency of which is to be designated by the attending physician. The chief objects and advantages of the physical examination program are as follows:

1. To place the worker in the occupation that suits him best and in which he can safely and efficiently perform.
2. To detect the presence of remediable physical defects in order to enable the workers to have them corrected.
3. To increase the longevity of the employee.
4. To reduce the death rate from natural causes.
5. To prevent the spread of communicable diseases by the exclusion of infected persons.
6. To reduce the annual labor turnover.
7. To reduce absenteeism.
8. To aid in the detection of the accident-prone man.
9. To reduce the possibility of delayed convalescence from injury due to complications following accident.
10. To make possible by conservation of health an older average age of employees.
11. To aid employees in health maintenance and reduce the cost of medical expense in the event of illness or injury.
12. To eliminate fraudulent claims for personal injury due to undetected physical defects.
13. To reduce accident frequency and severity rates.

The nurse is in a position to aid the physician in the physical examination program by the careful recording of the history of each employee—this should include the occupational history which is all too frequently omitted. Much of the detailed work of the medical service may be given to the well qualified industrial nurse, thereby conserving the time of the physician. Selling the physical examination program to the new employe requires a genuine interest on the part of the medical department. The employee who has correctable defects should be referred to the family physician. This is a very important phase of the industrial nurse's work and requires her close supervision.

The examination program should serve to guide the employment department in the placement of the worker, and should not be used for the purpose of elimination except when his condition is such as to endanger his health or the health of others.

Because of compensation laws, records of industrial injuries and illness are more complete than are the records of non-industrial injuries and illnesses. Record keeping is one of the most important duties of the nurse in industry. Records on all compensable cases are of great significance, since these serve as an economic barometer of the safety and health activities of the industry. Separate daily record sheets for injuries and illnesses, respectively, tend to simplify record analysis, and the daily or weekly summary sheets facilitate the monthly and annual report. Recording of illnesses is not the usual procedure in the smaller industries. Where this practice has been established, however, such records are invaluable from the standpoint of indicating to management where health remedial measures may be instituted. Especially is this true in the matter of respiratory diseases. Illness reports are commendable, as unless employees report upon their return to employment it is not known whether they are fit to return to their former occupation, and proper placement cannot be instituted. Findings on absenteeism have shown that the average worker loses 15 times as much time for non-industrial injuries and illnesses as he does from industrial injuries. Since much of this is preventable, we have additional tangible objectives toward which an industrial health program should be directed.

The nurse here continues her work as a teacher. The work and observation required in keeping these records make the nurse well informed on health and safe working conditions. Their careful analysis will show her the need for definite recommendations. Personal observations made by the nurse at the time of the employee's complaints are a distinct aid to the physician in his diagnosis. When the illness is not a result of the employee's working conditions, he should be referred to the family physician. Early medical care is encouraged, thereby preventing a prolonged illness. This is a most important function of the industrial nurse.

The nurse working alone in the small plant is the best known representative of health information. Her advice is sought in matters pertaining to illness, not only of the employee but also of the family. Her preparation, therefore, reflects the standards of the whole field of industrial nursing. Here her knowledge of the ethics of her profession stands her in good stead. If she fails she may be dismissed, and management frequently takes a definite stand in the elimination of the department.

The well trained nurse will not choose to work without standing orders from a physician. Where a selected group of physicians is maintained, the advice of one of these physicians should be sought, and standing orders signed by the physician should be followed. It is not possible for a physician to always be present, but he should be in sufficiently close contact so that he, not the nurse, bears the responsibility for diagnosis and treatment of injuries and illness.

Industry, as well as the nursing profession, needs to be protected against untrained or poorly trained women who are willing to endanger the lives of their patients by usurping functions which are the physician's. It is the unqualified nurse who violates the confidence of her patients, and so finds herself constantly in trouble.

THE United States statistics gathered from various states show that about 65% of all occupational diseases are dermatoses, and from these records it is estimated that there are at least 20,000 cases of occupational skin diseases of sufficient severity to cause loss of time from work. The nurse here plays a most strategic role in the control of these cases, through careful observation at the time of contact with the employee, which may lead to discovery of a definite skin involvment. These cases, referred to the physician early, may readily respond to treatment, the lack of which may cause chronic condition with the possibility of prolonged disability. In one of our large tanneries in Wisconsin, dermatitis has become almost non-existent through the close supervision of the nurse, the cooperation of foremen in checking the hands and forearms of workers exposed to chemicals, daily, and through prompt reporting to the physician of any signs of any type of skin irritations. Early medical care is given and proper placement of the worker follows. Protective clothing for each worker is the foremen's responsibility, and employees are taught the value of cleanliness and protection. Through this program management is saved insurance costs and labor turnover. The employe benefits by steady employment.

THE importance of the work of the industrial nurse depends on the nurse herself. Her opportunities depend largely upon her qualifications.

The handicaps or obstacles which lie in the progress of industrial nursing are as follows:

1. Inadequate preparation.
2. Lack of supervision (in smaller plants) where no physician is maintained.
3. Lack of organization.

As to the first, inadequate preparation, we have had so-called postgraduate courses in public health nursing in the United States for the last 30 years, and we have today 17 courses accredited by the National Organization for Public Health Nursing. A nurse completing a course in public health and entering industry, knows little of the personnel problems involved, and little, if any, of the manufacturing hazards. A knowledge of industrial illnesses and industrial accidents, as they affect the community as well as the industry, should be a part of the education of the industrial nurse previous to entering into the field of industrial nursing. The knowledge of a complete and thorough physical examination program in industry and its effect should be included in the public health

course. A more thorough training in the fundamental principles and proper execution of first aid is essential to the education of a well-trained industrial nurse. Public health courses and nursing education are aware of these needs, and steps are being made for their introduction into the curriculum.

As to the second, lack of supervision, the nurse working alone in industry has a distinct handicap. She must constantly draw upon her own resources if she is to become a success in this field.

And as to the third, lack of organization, for the past several years the National Organization of Public Health Nursing has made a special effort toward organization of the industrial nursing group. An industrial nursing section has been established and has cooperated with the National Safety Council in planning nursing programs for the National Safety Congress held each year. Through the interest of Mr. W. H. Cameron, Managing Director of the National Safety Council, who is also a member of the executive committee of the Industrial Nursing Section, a list of about 1,000 industrial nurses has been compiled in the Council office and a monthly bulletin on industrial nursing is issued.

The Public Health Nursing magazine has articles each month which are of special interest to industrial nurses. It is to be expected that there will be a definite increase in the interest in industrial nursing through these efforts. The following letter from an interested and alert industrial nurse will bring to your attention the fact that nurses in industry are aware of these handicaps and are thinking of ways and means by which progress may be made:

MISS RUTH HOULTON,
Associate Director, NOPHN,
30 Rockefeller Plaza,
New York, N. Y.

My dear Miss Houlton:

Of course I am delighted to hear of the proposed program to aid the industrial nurse in developing and extending her field. I think you are approaching the problem in the right way, by forming a committee or board made up of industrial physicians of wide experience and sympathetic to our cause; of representatives of management, carefully chosen for their far-seeing and progressive qualities; and of the best possible industrial nurse or nurses. With a group, as outlined, to aid in the formulation of standards and aims, your nurse consultant would have a strong bulwark and should be able to do much to help those of us who struggle alone.

Perhaps one of the greatest dangers attending our type of work is the tendency to relax, to take things too easy, to get in a rut. We work with so little supervision, there is no one to criticise us if we are guilty of overlooking our opportunities for service. So long as we assist the doctor in a satisfactory manner we probably get by. It requires unusual energy, vision and devotion, to work alone and stay alert to all the possibilities of service presented by this job called industrial nursing.

We need standardization of reports. The average nurse needs to know how to present her monthly and annual reports to management in such form that they will be read. She should know the exact cost of her department per man employed. She should know the severity and frequency rates of each division of her plant and be able to explain to each superintendent the means used to arrive at such comparisons. In other words, she should be not only a good nurse, but an executive, recognized as such, and just as capable of managing her own office as the superintendent of a division of managing his.

One of our most vital needs is adequate preparation for the field. Even those of us who have spent many years in the work can learn much from well-conducted institutes and round tables. As you know, there isn't a school in the country that really prepares a student for this branch of nursing. General Public Health courses help, but they still do not serve the purpose. Perhaps something similar to an internship may be the answer. After the nurse has finished her course, let her serve a few months in a recognized, accredited industrial dispensary, or, better still, divide her time among several, and I am sure she will benefit greatly.

We also have the problem of the small concerns who employ from 100 to probably 700 men. Most of these are without nursing service. It seems to me that with the new occupational disease laws, we should be able to sell them the idea of combining two or more such firms and having one doctor and one nurse serve both, or several, as working conditions may warrant.

If we can interest such bodies as The Iron and Steel Institute, Manufacturer's Associations, State and regional Safety Councils, the various State Labor and Industry Boards, as well as the private employer, we have a chance of selling industrial nursing to many more concerns.

Granted, however, that we be successful in these efforts, we must be able to fill these created positions with prepared nurses, capable of carrying on really worthwhile work. So many nurses who enter this branch for a short time fail because of lack of preparation, lack of adaptability, or simply because they are not temperamentally fitted for the unusual requirements of the job. Finally, they quit, or are let out and leave behind them unpleasant memories of an experiment that failed. It is hard to sell a firm the idea of replacing such a nurse with another one.

Please accept my apology for this long letter. At least you will know I am interested and heartily in sympathy with your efforts.

Sincerely,
BLANCHE LLOYD FRANCIS.

IN CONCLUSION, therefore, the well-prepared nurse has a distinct contribution to make to the community. In no service, however, does her potential usefulness exceed that of industry.

It is to be hoped that the future will bring about the realization of greater development in this important field of prevention, with the industrial nurses doing their important best to assist the industrial physicians and surgeons in this great work.

Discussion:

GERTRUDE F. JAEGER, R.N. (Swift & Co., Chicago): Miss Johnson has covered the field very, very well. In fact, I don't believe there is much I can add to it, other than another viewpoint.

We, as nurses, are particularly concerned with the small plant; the large plant, as Miss Johnson said, has adequate supervision. The nursing organizations are very anxious to gain the cooperation of the physicians in raising the standards of industrial nursing, in the training of the industrial nurses. Therefore I will talk more on the qualifications of the industrial nurse than on the other questions Miss Johnson discussed.

First, who has the selection of the nurse? In many

instances the doctor does not, although he should. I think if the doctor is not consulted initially, we should try to obtain his opinion—because who is able to judge whether the nurse is actually competent if the physician can not?

The nursing organizations in practically every large city have bureaus where they supply nurses who have had some experience in public health nursing, or perhaps, some experience in industrial nursing. But, as Miss Johnson said, we have not as yet established proper training for industrial work. The public health courses do not offer us any hint of what the industrial nurse will meet. The only place where an industrial nursing course is given today in the entire world is Bedford College in London. They have a very fine course, but we can't go to Bedford, and we are trying to introduce those courses in the United States.

The worker should be a registered nurse from a Class A school. Before she goes into industrial work, she should have some experience in public health, because we do not get in training that which will give us the broader outlook to enable us to be successful industrial nurses.

Many times the nurse is selected by the superintendent, or some other official, or somebody who had a pretty nurse take care of him as a private duty case. It is fine to have ornaments around. Everyone likes a nurse who is easy to look at; but when it comes right down to facts, we need somebody who can do the work that should be done in the industry.

Personality is one of the main essentials: the ability to get along with people. You will all grant that any cross-section of employees in the average industry is quite complicated. We have all types—from the most highly educated and the most refined to those who have had no opportunities at all. Therefore, the nurse must be able to adapt herself to the personality of each employee who comes in. She must treat all of them as fellow-creatures, and fellow-employees.

Important also is the educational background of the nurse—her school, her experience, and her ability to apply the knowledge that she has acquired either through education or by way of experience.

Will she work well with others? It is not necessary for me to dwell here on the difficulty in adapting one's professional training, gained on the hospital floors, to the industrial world. The probationary period is rather long. We have been taught to be very dignified professionally. We can not carry professional dignity into industry.

Also, the doctor might ask, is the nurse interested in advancing her work in education? When an industry finds it has a nurse who is not properly qualified, it should dispense with her services and look for another nurse who is better qualified.

Miss Johnson referred to the public health courses. We might add that, in order to be a good industrial nurse, one should have first aid work. We do not get that in hospital training. We should have personnel relations, industrial psychology training and social service courses whereby we learn of all the agencies in the city, all the facilities, so we can advise the employee where to go for any particular trouble. The nurse in the small industry has special need of this. We who work in the larger industries step across the hall into the doctor's office, pour our troubles into his ears, and he tells us what to do, and we are all right. But our problem today is the nurse in the small industry who doesn't have a full-time physician to supervise her work.

We do not presume to take any of the prerogatives of the physician, and thus our work is sometimes difficult when we are alone. The nurse who is well qualified will first make the employee feel comfortable when he comes into the doctor's office. A cheery "How-do-you-do," or "Good-morning," or whatever it may be, will put him at ease immediately. When she is taking the history of his case or making a record, she should ask him to be seated. That makes him feel at ease,—in the too often formidable atmosphere of the medical department. His fears, and his dislike of reporting to the doctor's office, are thus dispersed by the time he comes to the doctor.

Another question we have been discussing a great deal is that of standing orders. Doctors do not like to write standing orders, but nurses like to have them. In our Chicago area, for example, I, as Chairman of the Industrial Nurses' group here, have had many queries from nurses as to what they should do because they do not see their doctors sometimes for two or three weeks. It would be very fine if we could have standing orders, and it would relieve the situation very much.

Miss Johnson says the nurse frequently paves the way for the industrial physician. She does this, as I have ventured to elaborate, by her manner in meeting the employee when he comes in with his problem.

In the large plants, a nurse's work is more highly specialized—because we have specialists for this, that, and the other. We have sanitary engineers, and safety engineers, and, naturally, the medical chief. But in the small plant they do not—and the nurse has to do everything. The doctors who take care of a number of small plants may have a nurse in each of these plants or they may not; but where they have such a nurse, that is the nurse who would like to make better contacts and who needs them.

Then, we come to the examinations, pre-employment and periodical. The nurse can do very much to allay the fears of the employees when they come for these. Many are rather terrified when they are called in, and we know, of course, that this is needless, and can be overcome in practically every case by the nurse.

Then there is the matter of correctable defects. It is the nurse who so often gets the information they do not like to give to the doctor at their first meeting with him, either because they have known the nurse longer or because they are rather awed by their first contact with the doctor. It is peculiar that sometimes patients will tell the nurse what she thinks are all their troubles and symptoms. She puts these on the record and turns it over to the doctor, and then they tell the doctor an entirely different story. But it works both ways. Take the two together and we finally come to a conclusion as to the cause of the patient's trouble.

Record keeping is vitally important, and too great emphasis can not be placed on it because these records, as you know, are legal documents. That is one of the important things that should be impressed upon a nurse taking postgraduate work for industrial service. In the hospitals, we do learn how to make records, but in the case of an injury, the facts as to how it happened, where it occurred, when, and what part of the body was injured, etc., must be absolutely accurate. The doctor makes the diagnosis. But all the information the nurse can get is important, and gathering this information is of much assistance to the doctor in making his diagnosis. As I have said, the well-trained nurse will not assume any of the prerogatives of the doctor.

In the smaller plants we do not have the organization we should have. The nurse does not have her work organized, or her time organized. It is organization of self that I wish to refer to in this case, as well as organization in the plant. All that should come with the properly trained woman. The national organization of public health nurses is considering this at the present time.

The nurse should be encouraged to subscribe for magazines and to attend the industrial nurses courses. We have in Chicago at the present time an organization of industrial nurses comprising about 330 members. We have tried to have educational meetings. Within the last few months, one doctor spoke to us on "Heart and Industry," and another on "Tuberculosis and Industry." One personnel man talked on "Personnel Relations in Industry," and another on "Social Service in Industry." We would be very glad to have more of the industrial physicians offer their advice to us in this way.

I might say here that we owe very much to those who have gone before us. The nurses who started in 40 or 50 years ago had no training such as we have had. They were pioneers, and it is to them that we all feel we owe a great appreciation. It is our duty now to carry on what they have given us, and to improve it for those who in turn will be our successors.

Let me add this to the subject of the nurse meeting with people: I feel that any nurse who can not treat an employee as a fellow-worker, who is afraid to walk with her white shoes where any other women can walk, is not fit to be in the industrial field. If she goes in because of the regular or short hours, she doesn't belong there. She must go into industrial work because she feels she wants to help the worker in his field, to improve his conditions. There is much she can do.

What we do hope is that the industrial physicians and surgeons will be our big brothers more and more. They have been very fine in the past, and we would like to have them help us more as we go along.

DR. EDWARD C. HOLMBLAD: I can't resist this opportunity to thank Miss Johnson and Miss Jaeger for this presentation on industrial nursing. They have put forth the ideals that this organization has had for 22 years—ever since the American Association of Industrial Physicians and Surgeons was established. The men who formulated the object of this society, which you will find in the front of your program, have kept diligently at that same object in trying to better and improve conditions.

We now see the industrial nurses coming along and organizing for the chance of enhancing their opportunities and improving themselves. I was glad to hear Miss Johnson mention that industrial nursing should be really in the hands of nurses. We find so many matrons throughout the various plants holding down work that really belongs to a graduate nurse. It is most unfortunate that we have not had some means of bringing that under control. With the industrial nurses coming to the front, however, I think they will see to it that the employees are given the care that is due them. I believe a great deal of good can come from that.

Practical Problems under Blanket Coverage for Occupational Diseases

— A Review of the Illinois Claim Experience —

CLARK D. BRIDGES,
Safety Director,
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Chicago

YESTERDAY morning, Dr. Selby referred to the need for industrial physicians to take a greater interest and responsibility in industrial hygiene problems. Mr. Lamenzo also referred to the need for the industrial physician to collaborate with the industrial hygienist and the industrial ventilating engineer.

An analysis of the claims made under the new Illinois Occupational Disease Act during the first 20 months of its operation indicates a need for cooperation and understanding of other fields, also, such as a more thorough appreciation of the medicolegal aspects of occupational diseases, together with consideration of the most important problem in the industrial field today: that of industrial relations or personnel. In order to function effectively in the occupational disease field, the industrial physician can no longer limit himself to the pure practice of medicine and surgery, but must have considerably more than a speaking acquaintance with industrial hygiene, toxicology, engineering control, medicolegal aspects, and industrial relations problems in addition to preventive medicine and therapy.

Since October, 1936, when the new Occupational Disease Act took effect, there have been 431 occupational disease claims filed with the Illinois Industrial Commission for arbitration or approval of settlements. During the first full year of the Act there were 220 claims. During the first eight months of the second year, up to May 31, there were 211 claims, which is a significant increase in comparison with the first year because the first year included a number of silicosis claims with insufficient or no exposure under the new Act. This increase is not unusual in view of the definite association of occupational disease claim frequency with less than normal industrial activity.

As we have seen in the operation of the Compensation Act for industrial injuries, especially in the construction industry, when the end of a job is approached and there are no other building jobs in prospect, employees sometimes become injured willfully in order to draw compensation after the job has been finished. Under occupational disease compensation, the tendency to make it operate as unemployment insurance is increased many fold and becomes a serious problem.

FOR our purpose today, we have divided the 431 claims into the following groups:

Respiratory	255	59%	plus
Lead	89	20%	approximately
Dermatitis	45	10%	approximately
Other recognized occupational diseases	9	2%	approximately
Miscellaneous complaints	26	6%	approximately

We will dispose of the simple, regulation diseases first and consider the respiratory diseases and miscellaneous complaints last.

The dermatitis claims total 45, about 10%, which is a rather low figure, compared with other States.

There have been 89 lead cases from the industries which we would expect to produce them. One plant engaged in a particular type of business has produced more lead claims than all the rest of the plants in the same business in the State. This is the type of problem which illustrates the need for the coordinated efforts of the various persons indicated previously, the physician, the industrial hygienist, the legal expert, the ventilating engineer and the personnel department to

find the reason for the high frequency and take proper steps to correct it.

There have been a few claims for other occupational diseases which we are accustomed to expect. Two for undulant fever, one for tularemia, one for zinc, one for arsine and manganese, two for chromium, one for carbon monoxide, and one for radium.

Under the heading of miscellaneous complaints we have placed four claims for rheumatic fever, arthritis, rheumatic heart, etc., one of which was from the meat packing industry, another from a candy plant—the others indefinite as to industry; four claims for heart trouble, one from a laundry, one from the railroads, and one from the meat packing industry—the other indefinite; and the unusual claims such as amebic dysentery, varicose veins in a watchman, flat feet in a laborer, spurs on the heels of a theatre manager, athlete's foot, cerebral hemorrhage produced by overwork and exhaustion due to overtime and extra hours, syringomielia or softening of the spinal cord in a foundry employee resulting in claw-like deformation of the hands; and from a tannery we have one in which there is injury or illness affecting internally the upper portion of the spine, nerves and cords of the head and body.

BEFORE we consider a subdivision of the claims in the respiratory classification, we direct attention to the fact that complaints in this group seem to be receiving unusual emphasis (nearly 60% of total). While it is true that the portal of entry of most poisonous or harmful substances is through the respiratory tract, the pathological manifestations of most of the diseases which we ordinarily consider definitely occupational are seldom respiratory in their character with certain few exceptions (silicosis, asbestosis, acid poisons, sulphur dioxide, etc., occasionally anthrax, chrome ulceration, etc. Many diseases or poisons which are included in most of the schedule plans such as arsenic, lead, manganese, mercury, phosphorous, methanol, benzol, dermatitis, radium, bursitis, synovitis, tularemia, etc., seldom have any respiratory manifestations).

Subdividing the 255 cases in the respiratory group, we find 116 claims for silicosis, silico-tuberculosis, pneumoconiosis and asbestosis. The high percentage of this type of claim was entirely expected, as we have been through a clean-up period in which some industries went to extremes to protect themselves against possible claims. Unfortunately a number of the claims being made at the present time are apparently the result of over-reading of x-ray films. By over-reading is meant that fibrosis entirely compatable with age and past exposure has been called silicosis, and consequently many employees were needlessly thrown out of employment. We believe that since these original examinations were made there has been a better appreciation of the wide range of fibrotic conditions in industrial chests which may be considered entirely within the range of normal. In fact we now find that some more experienced physicians would rather hire an individual 40 or 50 years of age with extensive fibrosis or early silicosis than a young man with a perfectly clear chest for a siliceous dust exposure.

Included in this group of 116 are quite a few cases which did not have the required 60-day exposure and have been rejected. We have also included in this classification those claims where the allegation was "pneumoconiosis" although this term is undesirable because pneumoconiosis of and by itself is not descriptive of a disabling disease. Silicosis, or silico-tuberculosis, is preferable for use as describing the disabling phase of pneumoconiosis. Dr. Leroy U. Gardner has delineated the difference between these two terms and goes further to say that pneumoconiosis is no more disabling than the callouses on the hands.

In this group the industries which are principally responsible are, in the first place—foundries; in the second place—steel mills. The remainder are scattered among stove factories, roofing, quarrying and potteries, etc.

Of more than passing interest is the number of tuberculosis claims. There were 50 for simple tuberculosis (over 11% of total of all claims), however, a number of them are from industries which have some exposure to harmful dusts, such as foundries, potteries, etc. We will not go into the question of whether simple tuberculosis in such an exposure should or should not be compensable. This will doubtless be covered by Dr. Sander in his talk this afternoon.

The other tuberculosis claims, however, should give us considerable concern. They come from restaurants, bakeries, spray painting, printing, chemical manufacturing, paint manufacturing, garage operation, hospitals, etc. Some of these claims have been denied, while in others awards have been made where the exposure is of an order which we have in the past considered harmless. In a number of other cases the claims have been settled.

The matter of tuberculosis in industry has been a debated question for some time, and it is far from being within my province to state whether it is a compensable disease. My duty, however, as I see it is to direct attention to the fact that claims are being made from such exposures and to the increasing liberality on the part of courts and commissions in other States construing tuberculosis claims to be compensable. Notable in this respect were recent decisions in the states of Missouri and New York. There is a crying need for some intelligent and understandable precedent to be established, especially in States operating with blanket type occupational disease coverage.

If tuberculosis is made compensable by higher court decisions in operations which we have heretofore considered harmless, a great deal more attention to physical examination programs will be essential. We feel that any physical examination program designed to detect tuberculosis individuals cannot be considered in any other light than a distinct social service for the benefit of the individual, and the other employees who might have been exposed, as well as the employer.

There have been eight claims for pneumonia

coming from such operations as garage and motor sales, mining, paint and chemical manufacturing, inhalation of acid fumes while cleaning metals, and the transference of an inside employee afflicted with a cold to outside work in the winter time. This disease is also one of the disputed questions and it is likewise important that we have some decision on it. While most of us are willing to admit, I believe, that there are occasionally factors present in some processes of some industries such as siliceous dust or severely irritating fumes which may predispose or accelerate the development of tuberculosis, pneumonia, etc., we also feel that there is somewhere a line of demarcation between the occupational and the non-occupational, and it is urgent that this be established as soon as possible. It is at best a difficult operation to attempt to determine one's potential liability for industrial diseases until we know where industrial diseases end and non-occupational diseases begin.

There have been eight claims for bronchitis coming from operations as: dairies, printing, foundries, tunneling, exposure to nitrous oxide fumes, etc. There have also been eight claims for asthma from operations such as railroads, meat packing, mattress manufacturing, smelting, handling of organic dusts, etc. There was one claim for pleurisy and one claim for laryngitis.

There are 63 claims in the respiratory group which are too general for classification. In these cases the allegations are fibrosis, pulmonary disease, lung disorder, infected or congested lungs, cough, shortness of breath, etc. It will be seen that many of these allegations are merely symptoms and do not specify the disease upon which claim is being based, which is another shortcoming of definition-form occupational disease coverage. Quite naturally a number of these claims come from industries where there is exposure to harmful dusts.

In some of these cases the disease is probably silicosis. In many other cases, however, the disability claimed is probably the result of unemployment due to present economic conditions, and the allegations are actually only a statement of a condition or symptom rather than a disabling form of a definite occupational disease. In many cases undoubtedly it is nothing more than a condition or an ordinary disease of normal life which happened to be contracted while engaged in an occupation and might very easily have occurred whether the man was working or not working. It is most important however, to realize that many of these indefinite, uncertain complaints come from operations where there is no silica or asbestos dust. Many of them are founded upon exposures to nuisance dusts, harmless dusts, bad air, excessive humidity such as steam, and miscellaneous vapors, gases, etc., some toxic, some not. Therefore until we have upper court decisions regarding these symptoms and complaints and the exposures which produce them, we will have what we call for lack of a better term, "legal hazards."

We know what to do when we have a hazardous or borderline exposure to a harmful substance and can take proper precautions to control it, but with claims of indefinite nature and some others referred to previously coming from exposures which we have considered harmless in the past, we have an unknown quantity. As such, they require, by the very nature of blanket coverage, elaborate and expensive defense measures in order that the operation of the law will be restricted to its intent—compensation for actual *disability* resulting from truly occupational diseases. Unfortunately many of these claims are being settled for their nuisance value and the fact that there is such a thing as "nuisance value" must not be considered a secret any longer. Much unfavorable precedent was established under the compensation law by indiscriminate settlement of injury claims, especially hernia and disfigurement cases, and it required many years to remedy the practice once it was established. Manifestly we are confronted with waters much deeper and muddier in compensation for occupational disease and nuisance value settlements are to be be avoided at all costs.

IN ORDER to defend such claims it is necessary that we recognize this legal hazard and take proper engineering and medical steps to control it. To do this it will be found more economical in the long run by many employers to apply suitable engineering control measures to the operations which create noticeable amounts of dust, fume, vapor, gas, steam, etc., and to adopt more extensive physical examination programs. Many of the claims in this group and others referred to previously could have been forestalled if suitable physical examinations had been made in the first place and records showing the various abnormalities of the individual were available.

Whether the exposure with which you are concerned is remote, slight, borderline, or definitely hazardous, the physical examination program is one of great importance. But it has not received its proper share of attention in the past. In order to be of value for occupational disease purposes, physical examination procedure must be geared to the exact needs of each exposure. Perfunctory routine examinations are of little value in this respect. It is important that the physician understand the hazards of every exposure in the plant and their possible pathological manifestations and vary the examinations accordingly with the inclusion of suitable laboratory tests of urine, blood, etc., which will determine either susceptibility or previous damage, and in view of the trend in the claims being made, special attention must be given to the respiratory tract, heart, lungs, etc. Periodic and "exit" examinations should supplement the pre-employment in many exposures.

In order to cooperate effectively, it might be desirable for the physician to require the plant to furnish him with a job analysis showing the materials and processes to which the employee is to be exposed, and further, that arrangements be made for notice to him of all new materials obtained or new processes employed.

In conclusion, we feel that this analysis has shown the increasing importance of preventive medicine and that much progress can be made in eliminating occupational disease claims by its proper application by the industrial physician.

Discussion:

DR. C. O. SAPPINGTON: The problem of "borderline" cases is definitely one differential diagnosis between a true and typical occupational disease, and the non-occupational diseases. The reason that we have difficulty with borderline cases is because a great many physicians do not take etiology, or cause of occupational disease, strictly into account when making a diagnosis, relying entirely on physical, and laboratory findings, which is not done in the practice of other specialties in medicine. The solution of the borderline case problem, therefore, lies in knowing what the real exposure has been in industry, and understanding whether that has been adequate to produce actual occupational disease, knowing how to diagnose the disease in question, and being able to differentiate from non-occupational affections.

Mr. Bridges told you about what he calls the "legal hazard," meaning that claims for alleged occupational disease arise whether there is any *real* occupational disease hazard in the environment of employees; in other words, an employer who feels that he has no occupational disease hazards in his plant may, nevertheless, be called upon to defend himself. Too often, physicians, industrialists, insurance men, personnel officers, labor, and all others concerned in these problems, make the common mistake of committing the error in *reasoning* which Kant so memorably expressed as *"post hoc, ergo propter hoc,"* which means, literally translated, "after this, therefore on account of this." A typical example is taking a history and finding that a man has been employed where lead and its compounds are used—therefore, if he has any disturbances at all referable to the gastro-intestinal system, the blood, or the nervous system, he must have *lead* poisoning. And this is not an exaggerated example, for many times a diagnosis is made purely on the basis of this knowledge alone. The employer should not expect that because he *thinks* there are no occupational disease hazards in his plant, he is free from being called upon to defend himself in regard to claims. He should know what he has in his plant, and he should also know his men. This is the only safe way.

The incidence of pulmonary diseases is of considerable interest for several reasons; first, because the public has learned from silicosis experience that substances can be inhaled and cause difficulty; second, because the majority of industrial poisons and other deleterious substances cause disease after being inhaled. It may be of interest to know that the published higher court decisions of 1936, 42 in number, showed that all lung conditions accounted for 33. In 1937, of the 44 higher court decisions published, all lung conditions accounted for 29.

The need for "exit" examinations is not yet quite thoroughly understood. Except in organizations where periodic examinations are made with relative frequency and regularity, it is advisable to know what any employee shows, and to have a record of it, when he leaves employment. This procedure will pay for itself many times over, for there will be an increasing tendency for an employee to claim, after having left voluntarily or involuntarily the place of his former employment, that he had certain conditions at the time of leaving.

In conclusion, relative to peculiar claims, we will have these as long as we have peculiar attitudes. One quite naturally follows the other, and results from a lack of understanding and a lack of proper interpretation of the knowledge and material which we now possess. Peculiar claims are also, in a manner speaking, the penalty of general coverage. If the diseases were mentioned specifically, we would know in advance that only such diseases could be compensable under the law. However, under general coverage, an employee can put in a claim for almost any disease.

MR. J. C. WILSON (Lumbermen's Mutual): The approach our company has taken to these claims is right along the same lines as indicated by Mr. Bridges. I think it is the same attitude that practically any decent insurance company takes. It is our desire, first, to compensate any legitimate claim; but second, to fight the illegitimate claim; and at the same time attempt, at least, to clarify some of these laws that are very vague, and, in a sense educate the fellows who will operate under the laws.

From the industries' point of view, the occupational disease situation is one that can be controlled. To approach it, we know there is an occupational disease in a plant when the men show a condition that is unusual.

I was a little interested in the question of allergies this morning. I have had no doctor tell me yet how we can test the susceptibility of an employee for a final examination. We engineers find dermatitis and allergy in many plants only by accident experience and by actual contact.

So, our problem as engineers is to put the house in order, clean up the plant from every standpoint. You who were here yesterday saw some remarkably fine pictures showing that foundries can be cleaned up. I think that without exception every industrial operation can be safely exhausted or protected or isolated. Having once cleaned up the plant to a safe condition — and there seems to be some question in our minds as to what is a safe exposure to dust—then, clean up the man.

If the men are not physically fit for the jobs they are working on they can be shifted and put over in less hazardous occupations. Then go a step further and give a pre-employment examination to the new men coming in and see that they are properly fit.

In this undertaking, the personnel department and the superintendents, and the local physician and the engineers will all have to work together for the common good.

Operating nationally, as we do—in some states with occupational disease laws that have been in force for years, in other states where such matters are still governed by the common law, and in still others with new statutes, we have had the entire run of claims, both legitimate and illegitimate. I think one of the cases Mr. Bridges mentioned that is going to go as far as the road is cut out is one of our cases in Illinois on tuberculosis. It was inconceivable to us that this man had any exposure industrially that had any effect on his lungs, yet he has a tubercular condition. We are going to find out what the law shall say about whether we shall pay him. They have ordered us to pay, and we are going to fight that out.

It is perfectly true that in periods of depression every form of malingering, every possible form of claim, is multiplied. The man who knows he can get a job around the corner and get it without any arguing isn't going to monkey very long for a few dollars of compensation. But today, we understand, and I say this without any fear of contradiction, that a number of the men drawing compensation in some manner get on relief and in that way make a pretty good living out of the two. We know that if they are given a physical examination before they are put on in industry the opportunity of defeating an unjustified claim in the future is much greater than it is if they were not to be examined before they go to work.

A lot of us were criticized in Illinois, and I guess I had my share of that criticism, because of our efforts to examine the men before we accepted full coverage under occupational diseases. It was our feeling — and I don't apologize for it, and I argued it out with some of the officials in the industrial world at that time—that it was the reasonable procedure.

In 1912 we had an insurance law passed here when insurance men were not required, not even asked, to compensate an injured workman whose arm had been broken, eye knocked out, or leg cut off prior to the effective date of the compensation law. They have never asked us to do that in any of these things. Yet, when the occupational disease laws came in, they seriously

criticized us for wanting to know the physical condition of the men who were to be in on this exposure. We wanted to know whether they had tuberculosis. We wanted to know whether they had silicosis. There was only one way to determine that, and that was by a definite examination.

They said: "Well, what are you going to do if you find they are badly involved?"

I said: "I don't know. Somebody else will have to worry about that, because we are not buying dead horses."

We found dermatitis very extensively. I happen to have a friend in Illinois who is quite a dermatologist and pretty strong on allergy. He gave me the idea that a great many of these men who continued to show susceptibility to dermatitis must be allergic. We found one fellow whom we just couldn't cure. We used every type of hand protection, but the minute he would get back into the bakelite dust he would break out. Finally, we gave him a patch test—put him in the hospital and worked it out. We found he was "nuts" about eating boiled cabbage. We would get that fellow cured and ready to work and then just for fun we would scratch his back a little bit and give him a plate of boiled cabbage, and he was on fire—just like that! The records are full of similar incidents. The only thing to do was to take that man out of his job and make him quit eating boiled cabbage. We finally got him so that he was a pretty good worker—elsewhere.

The occupational disease problem is growing rapidly. I think the general social aspect of it is that eventually it will be so broadened that any man's disability from any cause will be a burden on industry if he was working at the time he became disabled or thought he was disabled. Perhaps we can get our relief associations lined up to decide intelligently for us which men are employable and which are not. The ones who are employable, I hope some day to see required to work or, as old John Smith said, "starve." The ones who are unemployable—without any doubt society will gladly accept the responsibility of seeing that they are properly cared for.

But, eventually, this occupational disease problem will extend much further than any of us now believe. We can just figure out that if a man who wants to work is not permitted to work, we will have to take care of him.

DR. LEOPOLD BRAHDY (New York): New York has had blanket coverage since 1935, and it will interest those of you who have to do with hospitals or have hospitals in your industry that the New York State Board has held tuberculosis an occupational disease in the hospital employee. The city of New York has had, since September 1, 1935, when this blanket coverage went into effect, 102 claims for tuberculosis including four among hospital physicians. It was the contention of the City of New York that tuberculosis is no more common among nurses and physicians than among the general population. But this was not considered sufficient and some 20 cases are being paid. None of these cases has been appealed to the courts, but it is probable that when a case comes up from some private institution an appeal will be taken.

All the cases paid so far, I believe, are cases for the municipal hospitals. Three-quarters of these cases are tuberculosis discovered among the nurses on routine examinations. They have x-rays every six months, a focus is found, and they are taken off for their own protection and for the protection of the patients. They may have no symptoms. Many of them have none. They didn't know they had it, and after they were told they were simply sent to some sanitarium. They may develop no temperature, no cough, and the lesions in some of them have disappeared completely in less than six months.

The problem is of interest from the standpoint of compensability. If this is to be compensable, what to do with these people afterward? Many of them are pupil nurses, and if tuberculosis is to be an occupational disease, no hospital will, of course, take them after they are graduated. Having once had tuberculosis the rate of recurrence being fairly high, they are a potential risk for any other institution and the problem of employing them is a serious one.

Of course, our hospitals have had other occupational diseases about which there has not been much question —for instance, scarlet fever in nurses who are attending children with scarlet fever. We had one case of amebic dysentery in a hospital employee and found there was a case of amebic dysentery in the ward. That was paid without question. Also, an orderly who stayed under the oxygen tent of a pneumonia patient and developed the same type was paid without question.

We have a more complicated question coming up: Scarlet fever in a nurse in a hospital where there was no case. She was in the pediatric ward. Was this an occupational disease? Is it reasonable to assume that children in the ward have carried scarlet fever to the nurse? My own opinion is that it is not a reasonable conclusion, but that is still to be decided.

Of course, if tuberculosis is finally to be accepted as an occupational disease among the nurses and hospital physicians, the question of standards, of exclusion of these people will come up. It is a very difficult question—the question of what to do with these people with healed signs of tuberculosis, no clinical signs, and no knowledge of ever having had an infection. It doesn't seem reasonable to exclude them.

The big problem after the decision is made—if it should be made that tuberculosis is occupational—is this question of standardization of pre-employment examinations among the nurses. It is a very difficult question and possibly in subsequent discussions in this meeting it will be taken up.

Developments in Occupational Disease Legislation

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SINCE workmen's compensation we have moved a long way toward closing the gap between the position of that unfortunate whose relief is on the sketchy side and the one who, sustaining a known injury, is compensated under the law for its consequences. We are providing, after a fashion and in an expensive, wasteful way, for the consequences of unemployment, old age and gradually for disease and ill health. One sometimes is inclined to ask, what next? If we are not careful we get into a confusing jumble of the inter-relationship of these social schemes such as to defeat their purposes in part and cause more real suffering than genuine relief. As this Conference deals with the field of occupational disease, it is pertinent to suggest that its deliberations are more than worthwhile in its effort to clarify thought and obtain a better understanding of that branch of industrial liability.

Your programs have been most interesting.

Often, however, I have noticed that a strain of doubt and uncertainty has prevailed over the classification of those ailments which should fall within the category of occupational disease, and if you have had doubts on this subject may I interpose the suggestion that it is not your problem alone, but that it is a universal problem. This uncertainty is reflected in the opinions of the courts, in the decisions of the administrators of such laws as prevail and in such legislative action as has been taken. The subject assigned me deals with the legislative problem, in the field of which I have had some experience, but this problem is so associated with the administrative, due to the more or less experimental efforts so far made as to make it necessary to delve into that experience.

First, let me say that in building our statutes we have probably stepped in the wrong direction by adhering too closely to the principles of workmen's compensation legislation as it deals with accidental injuries. There is a vast difference between the accidental acquirement of the ordinary injury and the cumulative causes of diseases commonly urged to be taken into account in charging industry with some measure of responsibility. The injury from accident is reasonably easy to determine, even though we frequently go wrong and get confused on the ultimate disease developments from it. But the onset of disease, unaccompanied by accidental injury, is different. There is no fundamental occupational cause for many of the diseases the burden of which is now being imposed, or sought to be imposed, on industry. Accidental injuries must arise out of and in the course of employment under most of the workmen's compensation laws, which plainly means that the injury must occur during the employment and must be caused by it. There is an event in that class of casualties, easily determined, from which the injurious consequences naturally flow. It, therefore, is the result of one of the hazards of the occupation. But a disease should not be charged to industrial operation unless it is produced by a hazard of the occupation, otherwise we go further than in workmen's compensation laws and, by construction, make of occupational disease laws, in practice, general health compensation laws. This, then, is our real problem in occupational disease legislation —to work out a fair and reasonable structure that will enable us to render to industry the obligations justly belonging to it and retain for the individual those obligations properly belonging to him. This is the problem of legislators in those states seeking to create occupational disease laws. Let us see what we have in the way of guide posts.

WHEN I was a student, we discussed a maxim found in some of the old law books, *sic utere tuo ut alienum non laedas,* which, in plain English, means "So use your own rights as not to injure another." The professors told us that, while this was an early maxim in the development of the law, it was so vague and undefined as to be incapable of true application to the complexities found in the relationships of business and of life. Strictly it would enjoin you from the use of your property if it might injure another in any manner or through the remotest of consequences. The construction of this maxim by the courts broke it down with limiting principles surrounding what we know as actionable negligence and proximate cause. Sometimes I wonder if the fertile minds devising present-day occupational disease legislation have not gone back to this old maxim and thrown away all the limitations, thus discarding all the practical experience centuries of life have taught. If they have done this, then we must devise again some limiting safeguards, for we will have the same burden in applying some of the modern occupational disease interpretations that were had in ancient times, with the same confusion in our life and business relationships.

In legislating the pattern for occupational disease laws, we have overlooked the principle of causation to a marked degree. Repeatedly have we confused the idea that, except for the specific diseases caused by the use of poisonous substances, speaking generally, most diseases are the product of erroneous living or lack of safeguards against hereditary tendencies and not the product of an occupational hazard. That same erroneous living may be and is commonly carried into and through the employment, but too frequently it is construed as a disease caused by the employment, where, at the most, the employment contributes only the opportunity for the onset of the disease. Thus some way must be devised to adjust the ailment found to the industrial hazard, where one exists. If there be no hazard other than the hazard commonly to be found in all occupations, we should not think in terms of occupational disease or, as in some cases, occupational injury.

We experience no particular difficulty with those diseases known to be peculiar to certain occupations. Where we have a clear diagnosis of poisoning coming from lead or from one of the other substances commonly found in industrial operations, and a history of continuous exposure in that operation with the same employer, we have little difficulty in adapting the general principles laid down in the familiar workmen's compensation pattern of legislation. But there is so much that is common to all occupations that may contribute to the inception and onset of a disease. For the most part true occupational diseases are of slow accumulation. It is difficult to define the amounts of contribution the hazards of employment may make toward such diseases, rendering the task of administrative bodies most difficult.

ADMINISTRATIVE schemes in workmen's compensation laws were designed to fit the accidental injury pattern, and in the laws of most of the states the word "accidental" is used. In shaping those schemes little consideration was given to anything except to assure the victims

of such injuries relief from the economic burdens caused by disability or death, and presumptions were created and procedure adopted to make the remedy swift and certain in operation. These do not fit occupational disease disabilities occurring in the course of employment, except that with some modification they may be fitted to those known to be characteristically occupational in their origin and the product of well known hazards of the employment in which the man is engaged. Where would industry be if, every time a man claimed he had developed tuberculosis or silicosis during his employment, a legal presumption was created that it arose out of and occurred in the course of the employment? How could such an unjust presumption be rebutted successfully? Many states have wisely surrounded the determination of such claims with safeguards designed to prevent the industrial chaos which would result.

When the British system was established the known frequent diseases from hazards created by industrial operation were specified. In New York we adopted this system setting forth opposite the specified disease the industrial operation known to produce it, and many other states have adopted similar systems. While at first we enumerated but a few well known hazards, others have been added, as time developed the need, until 28 diseases are now specified. While all of these diseases are well known and, to men of experience, rather easy of diagnosis, so that usually there is no outstanding medical controversy to be expected, necessarily most of them are of slow development so that we had to devise some special provisions to fit them into the procedure adapted to our accidental injury compensation law.

We had to consider the period during which such a disease would accumulate through a continuity of exposure, and this naturally varied with the disease and the hazard. We had to consider the fairest way of trying to apportion this period of accumulation to the various employers and insurance carriers covering. Our solution arbitrarily placed the primary burden on the last employer in which contraction of the disease could be had and permitted an application by him for apportionment to the different employers for whom he worked during the period of exposure, although this is a somewhat cumbersome task for the administrative authorities. Further consideration had to be given to the relation of time of actual disability to the time of exposure, particularly where exposure was had under different employers. We barred compensation unless disablement occurred within 12 months of the last day of the contracting period.

So much for some of the difficulties encountered in trying to fit scheduled occupational diseases to workmen's compensation accidental injury laws. When we have an open law, such as where the word "accidental" is omitted, or by general terms all inclusive coverage is given, our troubles greatly increase. Industry is subjected to a vague and uncertain liability against which, without proper limitations, it is powerless to guard. The problem may not be so serious in respect to all diseases, but it is particularly troublesome in those diseases classed under the general term of pneumoconiosis, and those where the so-called common diseases of life are involved. Difficulties of administration arise, uncertain liabilities are created, and insurance coverage becomes an extravagance.

After several years of specific coverage we, in New York, were suddenly charged with an all inclusive clause in 1935. Immediately our difficulties arose because of the uncertainty. Insurance rates were sharply increased and industries subject to the dust hazard, such as the foundry and stone cutting trades, suffered prohibitive coverage rates. A vast number throughout the state quit operations entirely. Where work was continued, strict physical examinations of employed men were instituted and many thrown out of service for defects. Men who had spent nearly an average economic lifetime in these much publicized hazards, alleged to be so menacing to their physical welfare, set up a most healthy howl against the action of their leaders which had lost them their opportunity to work, and demanded that their jobs be restored. The situation became so acute that the representatives of labor and others who had sponsored the all inclusive coverage petitioned for a severe modification of the law as applied to dust diseases, so that, less than a year later, the law was changed as to dust diseases to provide for an upward limit of about half the regular liability, with a clause excluding payments for partial disability and other relieving provisions.

This is but a sample of the results obtained by irrational legislation on a most complex subject. They did not count the cost of the accrued health impairment to men who had been in hazardous employments over a period of years, due both to their work hazards and the incidence of age, and imposed liabilities therefor on such employers as would continue operations following the effective date of the law. They overlooked the inevitability of strict health examinations in all industries to prevent any but the unimpaired from continuing at work, with a most natural acceleration of the ranks of the unfit unemployed that would be the result.

OUR problem is not confined to dust diseases, for the all inclusive clause has presented a serious problem of uncertainty due to a lack of clear definition of what is an occupational disease. My good friend Henry Sayer, Ex-Industrial Commissioner of New York, says it defies definition. I am inclined to suggest that when our mental processes work to the point where we know what an occupational disease really is we will find the English language adequate.

However, in looking over the field, I have found such attempted definitions of an occupational disease as these:

"It is one growing out of, incident to, or proximately caused by, the employment."

"A disease that is the natural and unavoidable result of the conditions of the employment."

"A disease peculiar to the occupation and due to causes in excess of the ordinary hazards of the employment."

"A disease which is the usual incident or result of the particular employment in which the workman is engaged."

"One that is the natural incident of a peculiar occupation."

"One wherein the cumulative effect of employee's continued absorption of deleterious substances from his environment ultimately results in manifest pathology."

"The natural and unavoidable result arising from hazards that are normally present and required in and are characteristic of and peculiar to, a particular trade, process, occupation or employment."

"A disease which is due to causes and conditions which are characteristic of and peculiar to a particular trade, occupation, process or employment."

"A disease which is due solely to causes and conditions which are normally and constantly present and which is characteristic of and peculiar to a particular trade, occupation, process or employment."

"A disease peculiar to the work or process carried on."

I have refrained from quoting the attempted definitions put into the Illinois and Indiana occupational disease laws somewhat recently enacted. As Mr. Sayer has said in a paper recently read by him they are not definitions but "an exposition and statement of conditions which must be satisfied before a disease can be said to give rise to compensation."

It should be noted that by not following the schedule method, industry in these states has let itself in for a line of litigation, although perhaps less markedly than in New York.

In June 1935, before the all-inclusive amendment became effective, the New York Industrial Board, at a meeting with its referees, offered the following definition for their guidance:

"The disease must be characteristic of and peculiar to the occupation to make it come within the provisions of the law."

While none of these definitions is air tight in preventing unwarranted inroads on the industrial treasury, the last one, if intelligently construed, was thought to describe best the common conception of an occupational disease.

Applying this definition to a specific case, our Industrial Board, in the case of an employee who worked as a counterman and clerk in a wholesale meat market in a normal temperature and who from 10 to 30 times a day entered a cold storage room where meat was kept, and was taken ill, which illness was later diagnosed as tuberculosis, ruled that the disease (tuberculosis) was not peculiar to and characteristic of employment in a wholesale meat market and denied an award. This case went to our Appellate Division where the court divided two and two on the propriety of the interpretation of the Industrial Board. The fifth judge, while indicating a leaning toward sustaining the Industrial Board's decision, voted to remand the case for further evidence. The case has not yet reached our highest court. In a case with similar facts occurring in California, an award was denied.

The second important case involving this question was that of a cashier or, ticket seller, in an outside booth of a moving picture theatre who claimed to have contracted a disease in her limbs caused by alternate heat and cold when the electric heater which she used was turned on and off. Our Industrial Board, in applying its definition, held the disease to be occupational. On appeal to the same court which decided the previous case the Board's determination was sustained, but when the case was taken to the highest court they held it not to be an occupational disease, giving us a definition fairly applying to the definition of our Industrial Board, the opinion, in part, being as follows:

". . . it was not the intention of the Legislature to change the Workmen's Compensation Law from a statute affording protection to employes against the hazards of their occupation to a law insuring against diseases which might happen to be contracted while the employee was engaged in his occupation. . . . Thus an occupational disease is one which results from the nature of the employment, and by nature is meant, not those conditions brought about by the failure of the employer to furnish a safe place to work, but conditions to which all employees of a class are subject, and which produce the disease as a natural incident of a particular occupation, and attach to that occupation a hazard which distinguishes it from the usual run of occupations and is in excess of the hazard attending employment in general. Thus compensation is restricted to disease resulting from the ordinary and generally recognized risks incident to a particular employment, and usually from working there in over a somewhat extended period. Such disease is not the equivalent of a disease resulting from the general risks and hazards common to every individual regardless of the employment in which he is engaged."

Even with the sensible and sincere efforts of the Industrial Board to solve a most difficult problem, we can anticipate litigation over a period of years to secure from our courts specific determinations for our guidance, and, without scheduled diseases enumerated in the law, it is not a pessimistic outburst to say that we will be charged with many of the common diseases of life for which industry should have no responsibility and which should be handled as a social health problem and not as a social industrial problem.

THE trend is clearly toward some form of occupational disease legislation in all states and jurisdictions that have adopted the workmen's compensation principle. New laws are constantly

being discussed by legislative bodies, and it is safe to assume that we will have to cope with this form of coverage wherever the workmen's compensation principle prevails. My experience tells me that unless the occupational disease coverage adopts the scheme of scheduling diseases and ailments, so much uncertainty will prevail that costly litigation and disappointments both to claimants and employers must necessarily result. Piecemeal legislation is also a consequence of uncertain coverage. Far better would it be to start with the experience and studies that have been made in various occupations in the different states, and in the scientific bureaus that have devoted much time to the question, and work out a specific coverage to meet all the known hazards.

In a very able paper presented by Professor Robert T. Legge, of California, he approves the statement made by Dr. Emery R. Hayhurst before this Conference a year ago, that there are 10 convenient headings under which known examples of occupational diseases may be grouped.

As I have indicated before, we have 28 specified diseases in New York.

The United States Department of Labor in 1935 published a chart showing a coverage for 63 separate diseases listed in the various compensation acts of the United States, Canada and England.

So it would seem if an act were devised to cover the known diseases by specification it would fully meet all social and industrial needs.

It is needless to say there is no great social problem in failing to cover a disease not yet known. Nearly every state has its Department of Hygiene, whose duty it should be to make a study of any new processes or new diseases, that would permit the insertion in the act when disease became so known as to be peculiar to a certain occupation. Little hardship could result from such a method of legislating with occupational disease. By this method there would be excluded from industry's burden the common diseases of life which everybody admits are not intended to be covered.

We thereby get away from vague legislation, intended to be honestly compensatory for losses caused by industrial hazards, developing into a general health insurance law for industrial workers.

I believe that by a clear understanding and close attention to this subject given by men such as are represented in the group before me, who honestly strive to solve the difficult problems connected with the occupational diseases laws, will we accomplish a safe and sane development of them.

Much has been said about prevention of occupational diseases as a duty of employers.

How can they be conquered or controlled if we do not know the contribution employment makes to the cause of so-called industrial diseases?

How can we legislate against something we know nothing about?

How can we intelligently impose burdens on industry to pay compensation for disabilities caused by some fancied ailments where there is no basis of experience so that industry may guard against it? The experimental efforts of the various laboratories will confirm the view that all too little is yet known of the manner in which some of the known diseases can be prevented.

How then may we guard against the unknown diseases imposed by unrestricted coverage?

The American College of Surgeons, in its recent pamphlet entitled "Medical Service in Industry and Workmen's Compensation Laws," says that of our 129,000,000 population it is estimated more than 24,000,000 are entitled to medical service under workmen's compensation laws. If we add unrestrained coverage of diseases to these laws we will be putting about one fifth of our population under an industrial health compensation scheme which, I think you will agree, should not be done without careful consideration of its effect economically and socially.

We should not treat an occupational disease law as a method of relief, any more than we should so treat a compensation law for accidental injury.

If an employment characteristically produces disability because of special hazards, it is fitting to provide reasonable compensation for the disability.

A tremendous burden is put on the medical profession properly to diagnose diseases occurring in industry, to appraise the effect of industrial exposures on advancing years, lowered resistance and hereditary tendencies.

Well may the profession study this subject with a view of preventing unwarranted racketeering and embarrassing inconsistence within our own ranks.

SUMMARIZING, I wish to say we are presented with a serious economic problem when we attempt legislation. While I have not closely checked the laws of each jurisdiction, a recent pamphlet of the Air Hygiene Foundation gives the following information:

"Twenty-one states and the District of Columbia now grant compensation for a growing list of occupational diseases. Eight other states are considering enacting such laws."

"Sound laws must be based on sound facts. Much remains to be learned about cause and prevention of occupational disease. Lack of uniformity in present laws is due largely to lack of basic knowledge."

These conclusions, reached by a sound research organization, are worthy of the most thoughtful consideration.

Let us segregate to industry only those burdens which belong to it and keep away as far as possible from legislation which is immature and disturbing to our economic life.

If we do that there will be afforded the maximum of just relief for all ills caused by the hazards of employment and little, if any, opposition to it.

Tuberculosis and Its Relation to Silicosis

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It has long been recognized that the tuberculosis death rate among certain industrial groups exceeds that in the population as a whole. Causes for this effect of industry have concerned public health and tuberculosis workers for many years and numerous factors have been attributed to it. Dublin[1] in his "Twenty-five Years of Health Progress" mentions the deleterious effect of various industrial dusts as the chief cause, with poorly ventilated workshops and factories, unsanitary working conditions, and excessive physical exertion in some occupations, as contributory. Jessamine Whitney[2] in "Death Rates by Occupation" considers the economic factor as of at least equal importance. The British Registrar-General[3] has shown that the death rate is highest where the standard of living is lowest, and vice versa.

Dr. Riddell[4] of Ontario, who addressed this Association on this subject last year, mentioned other factors to be considered, such as, (1) over-crowding of workers in shops and plants favoring disease spread, (2) posture at work interfering with lung ventilation, (3) poor plant ventilation, as well as exposure to various types of dusts or fumes. Lanza and Vane[5] in their analysis of the Metropolitan Life Insurance Company death rates have suggested that the influence of silica dust exposure is considerable, over and above the economic factor. That this undoubtedly is true is indicated in the numerous studies that have been made in the past 15 or 20 years in the various dust-exposure industries. Analysis of these leads one to the inevitable conclusion that the more intense the exposure to free silica dust, the greater the tuberculosis morbidity. In a previous report of tuberculosis in foundry workers,[6] which was a partial analysis of the series being reported here, it was conclusively shown that active cases were 10 times as prevalent among those with silicosis as among those without. The present report, which is the first analysis of our total series, confirms this observation and presents an explanation for this constant finding.

Another factor which has been mentioned for certain occupations but little stressed has been the fact that certain industries attract persons who are subnormal physically. Many of these are trades which require little or no physical exertion, examples being tailors, clergymen, cigar makers, etc., in which the tuberculosis rate is high because a large proportion undoubtedly were tuberculous when they entered those trades. Our study suggests that this may be true for several of our Milwaukee industries and its effect on our tuberculosis rate among silicotics will be discussed.

Wisconsin has had its Occupational Disease Law since 1919. By 1930 employers in our state who were faced with increasing numbers of claims for tuberculosis among workers exposed to dust, came to realize that an investigation of the situation was necessary. They knew that a reduction of the dust hazard alone would not suffice. As a result, a thorough-going tuberculosis case-finding study was started in 1932, which included not only a complete physical examination of all workers exposed to industrial dust but a chest x-ray film on each as well. All cases in which the x-ray film suggested tuberculosis in one form or another have been more thoroughly studied with various laboratory tests, such as the blood sedimentation test, sputum analyses for tubercle bacilli, and blood counts. Those whose tuberculosis was found inactive at the first examination have been re-examined at frequent intervals, so that any reactivations are discovered as early as possible. The tuberculin test could not be used as a screen in this investigation, because the necessity of reading the reactions two days later made it impractical. The test has been used, however, in cases involving problems of differential diagnosis. A still further test has been added to determine the presence of tubercle bacilli in the stomach secretions in cases of silico-tuberculosis in which repeated sputum analyses have been negative.

Upwards of 30,000 workers engaged in numerous dusty trades have been examined in this manner in Wisconsin in the past five and one-half years. It has been the author's privilege to have personally observed somewhat over 15,000 of this group, comprising the major portion of dusty-trade employees in the Milwaukee area. Somewhat over one-third of these, or approximately 5,000 workers, have been observed serially during a five-year interval. The data from these examinations have been transferred to tabulating punch cards, making the information from this series readily available for statistical purposes. The statistical code which was originally set up with the collaboration of Mr. Cummings of the Saranac Laboratory, is a rather complete one and is available to other groups carrying on this type of study.

Tuberculosis by Occupational Groups

Our material has come from numerous industries, but from Table I it can be seen that the largest group is composed of foundry workers, a total of 7,923 or slightly over 50% of the whole series. The second largest group are those who have never worked in a dusty trade, 6,703, or about 43% of the total number examined. This would be an ideal control group except for the fact that about one-half are boys ranging in age from 17 to 25 who were just entering a dust exposure industry. As a result, the average age of this group is 23, whereas that of the foundry workers is 45, which must be borne in mind when comparing the tuberculosis incidence of the various groups. The granite workers total 229, or only 2% of the whole series. Their average age, however, is approximately that of the foundry workers. The 180 electric arc welders are listed separately because

TABLE I — TUBERCULOSIS FOUND AT ORIGINAL EXAMINATION BY OCCUPATIONAL GROUPS

Class of work:	Total number	No. with silicosis	% silicotic	Active tuberculosis				Activity of tuberculosis indeterminate			
				Total no. with active tb.	%	% of silicotics with active tb.	% of non silicotics with active tb.[6]	Total no.	%	% of silicotics with indeterminate activity	% non-silicotics with indeterminate activity
Never dust exposure	6703	0	0	12	0.2	.....	0.2	59	1	.....	1
Foundry work	7923	479	6	34	0.4	3	0.2	250	3	19	2
Granite work	229	51	22	5	2	10	0.6	55	24	67	12
Electric welding (not from foundries)	180	0	0	0	.....	.....	.....	3	2	.....	2
Miscellaneous dust exposure	544	20	4	8	1	20	0.6	16	3	25	0.8
TOTAL	15579	556	.....	59	0.4	.....	.....	383	2	.....	.....

of the possible significance of the absence of tuberculosis. A report of the findings in some of these welders was published recently[7] and will not be discussed here.

The 544 individuals grouped under "miscellaneous dust exposures" represent some 32 distinct occupations, but the number of cases under each was too small to warrant separate listing. Many of them are foundry workers now, whose previous occupations were more significant from a dust exposure standpoint. The eight active tuberculosis cases had their most significant exposures as follows: two coal miners, and one case each as gold miner, cutlery grinder on sandstone wheel, copper miner, iron miner, marble cutter and quartz quarryman. With such a heterogeneous group, it obviously is not possible to draw any definite conclusions regarding tuberculosis incidence.

Study of the tuberculosis rates in the other groups suggests only one conclusion, namely, that silicosis is undoubtedly the chief contributor to the elevated tuberculosis incidence in our dusty industries, the rate being more than 10 times higher in silicotics than in non-silicotics. This confirms our previous observations of the foundry workers and establishes conclusively the effect of silicosis on tuberculosis morbidity. In computing these data, only clinically active cases were included, but we do not consider it necessary to demonstrate tubercle bacilli before making this diagnosis. In the absence of a positive sputum or stomach washing for tubercle bacilli, at least two of the following must be positive before the "active" diagnosis is made:

1. Medium moist rales after cough over the lung lesion.
2. Clinical signs of toxicity, i.e., characteristic fever, weight-loss, etc., in absence of other causes.
3. Blood sedimentation rate of 20 mm. or more per hour in absence of other causes.
4. Progressive spread of infection shadow on serial x-ray film study.

When all of these criteria have been negative, such cases are classified as "indeterminate activity." Many without doubt are pathologically active, but the infection is so well localized that they are clinically inactive. This is particularly true with chronic silico-tuberculosis, the majority showing no spread of the infection or other evidence of activity for many years, and sometimes never. That explains the very high percentage of "indeterminate activity" cases among the silicotics in Table I. Other cases classified as "indeterminate activity" are, without doubt, pathologically arrested or healing, but differentiation between this group and that which is pathologically active sometimes is not possible during life. Cases have not been classified as "healed" unless the x-ray shadows are definitely calcified along with all signs of clinical inactivity.

Of considerable significance in Table I are the low tuberculosis rates in workers exposed to dust who have not as yet developed silicosis. These figures suggest that the increased incidence of tuberculosis in dust-exposure industries is limited to those who have a definitely established silicosis. Dust exposure per se in the absence of silicosis does not appear to be responsible for an increased tuberculosis morbidity. This differentiation definitely establishes the case of clinically active silico-tuberculosis as occupational. It is the only type of tuberculosis of which we have clinical proof of its occupational character in these industries. The ordinary case of uncomplicated tuberculosis discovered among dusty trade workers differs in no way from the tuberculosis found elsewhere, even in its incidence.

Active Tuberculosis by Age Groups

FROM the graphs and charts to be presented below, an attempt will be made to explain this effect of silicosis on the elevated tuberculosis morbidity. In order to better understand this relation-

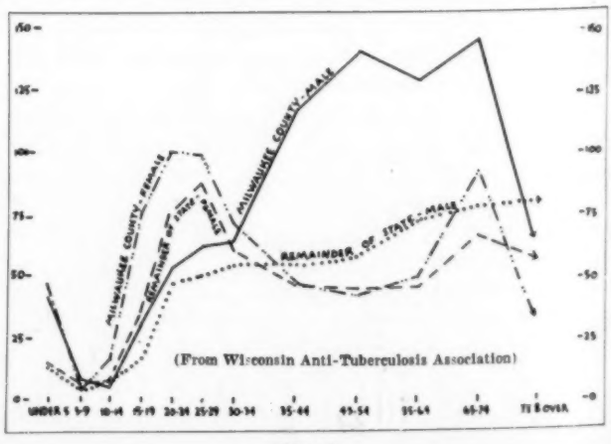

Fig. 1.
Tuberculosis Death Rates—per 100,000 Population—Milwaukee County and Remainder of the State—Male Compared with Female (Three-Year Average, 1930-1932—Corrected for Residence)

ship, a study of the mortality rates by age groups is necessary. The graph prepared by the Wisconsin Anti-Tuberculosis Association is of special interest because it compares the mortality in Milwaukee County, which is largely industrial, with that in the remainder of the state, which is largely rural (Fig. 1). The male death rate in Milwaukee County reaches a peak of approximately 140 per 100,000 in the age group from 65 to 74, almost twice as high at those ages as the female in Milwaukee County or the male or female in the remainder of the state. The only possible explanation for this marked difference in the male Milwaukee rate in the later decades is the effect of our industries on our male workers.

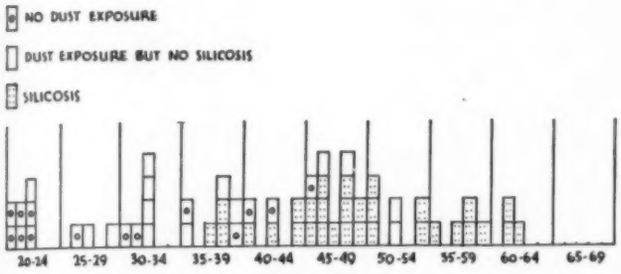

Fig. 2.
Fifty-nine Active Tuberculosis Cases Found on Original Examination

When the 59 active tuberculosis cases found at the original examination in our series are studied by age groups, an excessive grouping of active cases with silicosis after the age of 40 is noted (Fig. 2). Although active tuberculosis can occur after the age of 40 in the absence of silicosis, the cases are relatively few as compared with the silicotics. This graph offers rather definite proof that silicosis is the factor which increases the number of clinically active tuberculosis cases in the later decades in life, but it gives no explanation of why this is true. The question always arises in studying individual cases as to how long the tuberculosis may have been present. Was it a recently acquired infection in a silicotic lung or had it been present since the earlier decades? Figs. 3 and 4 throw some light on these questions.

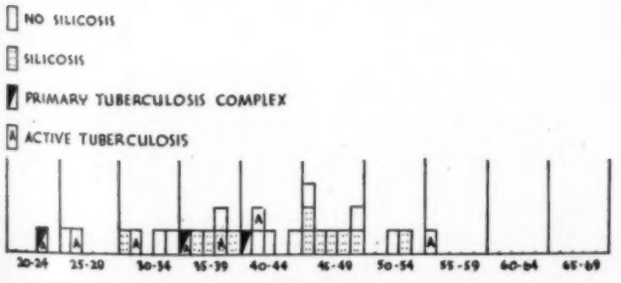

Fig. 3.
New Tuberculosis in Previously Uninfected Lungs (29 Cases—12 with Silicosis)

In the periodic examinations of 4,971 workers during the five and one-half years of this study, 29 without x-ray evidence of infection at previous examinations were found to have developed an adult tuberculous lesion (Fig. 3). In only seven of these has the tuberculosis been classified as active and in only one silicotic lung was this active infection apparently superimposed. This single case (age 38) was of the rapidly spreading peri-nodular type. In the 11 other silicosis cases in this group, the infection was an x-ray diagnosis in which no clinical activity could be demonstrated. In the majority of these no further spread of the infection shadow has occurred after several more years of observation. In other words, the reinfection lesion has become chronic and is not a rapidly spreading process. There have been 12 silicotics, therefore, who originally were classified as uninfected who subsequently developed a reinfection (or adult) lesion. Because in 11 of the 12 the infection became localized and remained inactive clinically, one must suspect that the reinfection was endogenous from a primary infection focus, either in the lung or elsewhere, which was not detectable by the x-ray film. In the one rapidly spreading case of the peri-nodular type, on the other hand, it is quite likely that the source of the reinfection was exogenous. The possible significance of this differentiation will become apparent later.

A further point of interest in Fig. 3 is that only one silicosis case above the age of 50 has developed an adult tuberculosis, although the majority of our simple silicotics are in the age groups above 50. It should be noted also that several non-silicotics developed their first adult (or reinfection) tuberculosis in the later decades, one at 55, two others at

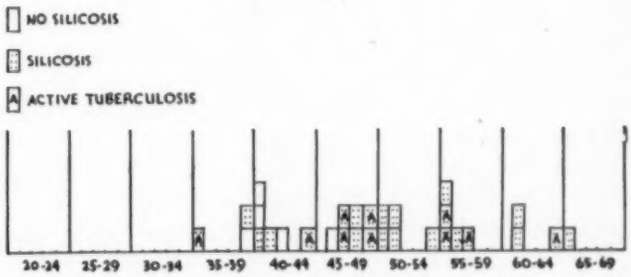

Fig. 4.
Breakdown of Previously Localized Tuberculosis (30 Cases—25 with Silicosis)

52 and 49. In Fig. 4, we see the end-results of many years of well localized and clinically inactive silico-tuberculosis. Twenty-five of the 30 cases are silicotic and a large proportion have become clinically active. For reasons which as yet are unexplainable, the infection finally has broken through the dense barrier of silicotic fibrosis late in life and has spread bronchogenically. The majority of these cases die of a caseous bronchopneumonia.

Summary of Effect of Silica Exposure

FROM our observations of the cases shown in these tables and graphs, our concept of the effect of the silica dust exposure on the tuberculosis rate has become more clearly defined. In the majority of cases of silico-tuberculosis which we see, the lungs undoubtedly became infected with an adult lesion before age 40 and the first effect of the silica inhalation was to aid in localization of the infection. Whether infection occurred before dusting began or after makes little difference at this time on the course of the case. The accumu-

lating silica tends to make the infection extremely chronic, throwing around it a dense wall of fibrosis, such that clinical evidence of activity is entirely lacking for many years. Some of these cases may have had their lives prolonged by reason of their silica exposure, but most of them probably would have healed their infection spontaneously had they not been exposed to dust. It is this effect of silica which is the deleterious one, namely, the tendency to keep the bacilli alive and aid in their multiplication as more and more silica accumulates in the lungs. In other words, the lesions are kept pathologically active by the silica, so that in the later decades when silicosis has become established and the protecting wall of fibrosis breaks down, a massive spread of the infection occurs, followed by clinical signs of its activity.

It should be emphasized that this concept of the silica effect on the tuberculosis mortality is stated as being the usual one in our experience, but it is not necessarily the rule in all cases. It is not possible to be too dogmatic with such a disease as tuberculosis, particularly when it occurs in the form of silico-tuberculosis. That the latter is a true disease entity of itself and not merely a summation of the effects of silicosis and tuberculosis has become more firmly impressed on our minds year after year. It is so different from either tuberculosis or silicosis alone that neither is recognizable as a separate entity in some cases. Gardner and Brumfiel[9] speak of "an almost symbiotic relationship" set up between the tubercle bacillus and the human host, so occult are the lesions for many years. These are the cases that are all too frequently diagnosed as uncomplicated third stage silicosis because of the absence of clinical and laboratory evidence of the infection. Conglomerate and massive fibrosis shadows in a silicotic lung are in most cases due to a pathologically active silico-tuberculosis. That the majority of the silicotics we have diagnosed as having infection with "indeterminate activity" are of this type, we are becoming more certain with each year of observation because of the increasing numbers developing clinical activity of the infection late in life.

It should not be assumed from this discussion, however, that all silico-tuberculosis cases eventually die of a tuberculous pneumonia. In many the infection continues to remain localized and never breaks down. We have under observation numerous persons in the sixties and seventies who undoubtedly have a pathologically active infection which has shown no indication of breaking down in the five years we have seen them. The factor which causes the breaking through of the infection in some cases and not in others remains an unknown quantity. It is possible that the silicotic wall around the infection is so dense in some of these cases that it acts as a perfect barrier to the infection. It is these whose cause of death often is a failure of the right heart.

Effect of Foreign Birth on Tuberculosis Incidence

ONE additional factor not previously discussed is the effect of the large percentage of foreign-born workers in our dust exposure industries. These immigrants were naturally attracted to those trades in which they could gain ready employment at a living wage, which is particularly true of the foundry industry. Our series suggests that many from certain sections of Europe already were tuberculous when they entered our foundries and consequently have been a potent factor in the silico-tuberculosis incidence.

By the 1930 census, 19% of the total population of Milwaukee County was foreign-born. In our series of 15,579 workers from various industries, 42% were foreign-born, and this includes a large proportion of workers of the second generation, i.e., those born in this country of foreign parentage. When we consider only those with silicosis, i.e., the older workers in these industries, we find that 73% were born outside of this country. Since so many of foreign birth drifted into these dust exposure industries, one would reasonably expect their tuberculosis rate to be higher than those not exposed to dust. It is so much higher, however, than one would expect from the dust exposure effect alone that some other factor must be considered in addition.

In 1934, the Wisconsin Anti-Tuberculosis Association analyzed the tuberculosis death rate in Milwaukee County for a three-year period (1930-32)[8] and found the foreign-born rate approximatley three times that of the native-born of native parentage. The most significant finding in their study was the Polish-born mortality rate which was three times the rate of the German-born. This correlates very well with the morbidity rate in our series of workers in that frequency of tuberculosis among the Polish-born was twice that of our German-born group. This is of special significance because the two nationalities are almost equally represented in our series. Furthermore, we have had a considerably larger proportion of active cases from several Balkan countries than was their representation in the total group. It is safe to conclude that a sizable proportion of our immigrant industrial workers already were tuberculous when they arrived in this country and that had only native-born labor been employed in these industries, our silico-tuberculosis rate would be considerably lower today. Mr. Holand, the statistician of the Wisconsin Anti-Tuberculosis Association, concluded in his report that "occupational hazards appear insufficient to explain a tuberculosis death rate of two to three times higher among foreign-born men than among native-born men."

Discussion

A TRUE understanding of the various types of tuberculosis found in industry has a far-reaching practical significance. The mere diagnosis of clinically inactive tuberculosis or silico-tuberculosis is of minor importance as compared to the prognosis of these individuals. What will they do in the next five or 10 years? What is the proper procedure to follow to help them maintain this clinical inactivity? Should they be hospitalized the same as clinically active cases when we are certain that we are dealing with a pathologically active case, even though they are able to do

their regular work without symptoms? These are problems which require all of the clinical acumen and intelligent handling which can be mustered and each case must be dealt with individually. No one wants to deprive a wage earner of his job when there is any doubt that bed rest and other modern methods of treatment will at all alter the future course of the case.

Gardner and Brumfiel[9] have recently suggested a very intelligent solution of this problem. For the rank and file of workmen whose degree of intelligence does not permit them to grasp long-range health problems, they suggest that they be kept at work under close medical supervision, which necessitates frequent periodic observations. It may be necessary to transfer some to other work during the course of their observation, i.e., work which involves a minimum of physical exertion and exposure to dust. For men of superior intelligence, on the other hand, the ideal program of complete rest and modern treatment should be started promptly even though all evidence of clinical activity is lacking. A few such cases seem to have arrested the pathological activity of their infection, but it is too early to predict the complete healing of the infection in the silico-tuberculosis cases.

Another practical consideration resulting from these studies involves the question of employability of the early silicotic who has no evidence of tuberculosis. How far can we go in assuring him that his chances of eventually developing a clinical tuberculosis are no greater than in his non-silicotic co-worker of the same age? We now feel that we can go considerably farther in this direction than we thought we could when these studies began. To the silicotic of 50 or over, we now are giving this assurance with almost complete certainty. To the man in the forties, we are somewhat more guarded in our prognosis, although the development rate of tuberculosis in the silicotics in this decade is far lower than was originally anticipated. In other words, the frequently quoted statement "silicosis makes the lungs more susceptible to tuberculosis" does not express the true relationship between the two conditions. The superimposition of a new exogenous tuberculosis in a silicotic lung in the later decades is rare. The uninfected silicotic of 50 or over should be given every assurance that his chances of escaping a complicating tuberculosis are exceptionally good, provided he is protected from contact with open cases in his home or at his work.

From this discussion, the necessity of an intelligent tuberculosis case-finding program in industries involving any degree of silica hazard is apparent. Active and open cases in our plants must be found and promptly isolated in order to prevent contact infection of previously uninfected workers. Periodic observation of all employees is essential because of the few who yearly become clinically tuberculous, so as to isolate them at the earliest possible moment. Employees with clinically inactive tuberculosis, whether silicotic or not, must be observed at much more frequent intervals, not only to protect the fellow-employees but to bring those who become clinically active under prompt treatment before large portions of previously healthy lung become involved. Although reduction of the dust hazard is essential, the employer who does no more than that is not fully carrying out his duty in maintaining the health of his employees. With an intelligent case-finding program, the mortality peak in the later decades of life which can be attributed largely to industry will flatten out and possibly even fall below the rate in the earlier decades. Industry will then have accomplished its part in the elimination of tuberculosis as a public health problem.

Conclusions

FROM the tuberculosis case-finding program in the dust-exposure industries of Wisconsin, somewhat over 15,000 individuals were included in the series being reported here. Approximately 5,000 of these have been studied serially over a five-year interval.

2. The tuberculosis incidence in this series has been found to be consistently higher in those industries having a silica dust hazard, but this increase is limited to those individuals having a recognizable silicosis.

3. The effect of silicosis on the tuberculosis morbidity has been discussed in its relation to the evolution of a typical case of silico-tuberculosis.

4. This series suggests that relatively few cases of silico-tuberculosis discovered late in life are recent new infections, but that the majority were infected in the early decades and remained chronic, clinically inactive infections for many years.

5. That most cases showing massive conglomerate shadows roentgenologically are true silico-tuberculosis and not uncomplicated third stage silicosis, is suggested by the increasing numbers of this type that are being seen to develop a clinically active tuberculosis late in life.

6. The possible effect of the large percentage of foreign-born workers in these industries on the increased silico-tuberculosis incidence has been discussed.

7. The necessity of a thorough tuberculosis case-finding program in silica-exposure industries has been stressed.

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Discussion:

DR. R. D. MUDD (Chevrolet-Greyhound Foundry, Saginaw): About 18 months ago, I began the examination of approximately 5,000 foundry workers—rather, 6,000 at that time—at the Chevrolet-Greyhound Foundry at Saginaw. While I do not wish to minimize the industrial causative factors in tuberculosis, I want to stress a point that we have been trying; namely, the cooperation with the local health agencies in carrying out our case-finding program. We started out by getting cooperation of the local public health authorities, the local tuberculosis society, the medical society, and also the local x-ray men. All of the employees were to be examined, and up to about five weeks ago, we had examined 4,750 of them.

I tuberculin-tested all those who showed any evidence of a leaning toward tuberculosis; those who gave any history of tuberculosis in their own past history or in their family history or contacts; those who coughed or were underweight or had any suspicious signs. There were 458 such persons, and we found a very high rate of positive tuberculins; namely, 88%.

This, of course, would make it unnecessary for us to continue our tuberculin test, but it gave us an idea as to the prevalence of positive reaction in our industry.

Then we reported all of these positive tuberculins to the Board of Health and to the tuberculosis society and the tuberculosis nurses. They went into the families of all positive reactors and studied the children and wives.

Then all of these positive reactors were listed for x-ray and the company entered into a contract to pay a part of this cost. As a result, 218 were x-rayed, and we found 13 active cases in our own employees, and 32 healed primary cases. The point I want to emphasize, which I consider very important, is that the nurses found a fairly large number of active cases in the families of these employees. In one case we tuberculin-tested because the man's wife had died of tuberculosis. His x-rays were negative, although his test was positive. The nurses found the children in an orphan asylum. They routinely got them in for tuberculin testing and found three active adult cases of tuberculosis among six children, and two had primary types which were apparently healed, and one was free. They, therefore, tuberculin-tested the whole orphan asylum.

I bring that out in order to show to what extent we in industry can help the local tuberculosis campaign by cooperation, and by not concealing x-ray reports from the proper authorities.

A point I want to mention, too, is that among these 32 healed cases, of which I was able to study 31, 12 of the men had worked in the molding part of the foundry an average of 7.4 years and none of these 12 had any silicotic changes. All of them had healed primary types, and had worked those 7.4 years without becoming activated.

We also had 12 in the core room. None of these had silicotic changes, but, incidentally—which probably must be considered unusual—none of the 13 active cases previously mentioned had any silicotic changes.

And one more point I want to make is that I do not believe tuberculin testing is going out of the picture by any means. Even though we are now getting 88% positives, if our campaign is to be successful tuberculin positives will continually reduce until, in a few years, tuberculin positives will probably be 25% and negatives 75%.

That is what we hope for, but we must watch out for this tuberculin-negative group. In other words, these people who are working in a foundry, or in granite, and who are tuberculin-negative are a great hazard as far as acquiring tuberculosis is concerned.

The last point I want to mention is that we have experimented in hiring a few arrested cases of tuberculosis on the suggestion of the local tuberculosis hospital and also the state hospital. We put them on guarded jobs and have had excellent results from that procedure.

DR. LEOPOLD BRAHDY: The one remark of Dr. Sander's which I think is of especial significance is that silicosis is a disease entity in itself, whether or not there is a secondary infection.

In that connection, it is important to recognize that silicosis goes on to break down abscess formation, cough, temperature, spread of the lesion, so that you have every single sign except the presence of tubercle bacilli in silicosis that you have in ordinary tuberculosis.

Ornstein, in New York, has had a number of autopsies in cases diagnosed as silicosis complicated by tuberculosis. Postmortem findings showed no tuberculosis. Careful section of the abscess walls failed to disclose any evidence of tubercle bacilli. And he goes so far as to state that there doesn't seem to be any particular susceptibility on the part of the silicotic to tuberculosis.

We seem to be going too far, but the important point is that the diagnosis in the absence of tubercle bacilli is a very difficult thing, and also a most important thing, because these silicotics with pyogenic infections must not be sent to tubercular wards or sanitariums.

I don't know about the sedimentation rate without tuberculosis being proved.

An important question, of course, is what to do with these people, whether to leave them at home or send them to an institution. Without this very careful going over, a most thorough search for tubercle bacilli, the diagnosis is always in doubt.

The cases ordinarily present pictures not distinguishable from tuberculosis, so that statistics based on clinical examination must be taken with some skepticism. The statistics based on autopsy records do not indicate so high a rate of tuberculosis among the silicotics as in the clinical records.

DR. A. W. GRAY (Milwaukee): I think it is very important for us once in a while to stop and inquire of ourselves what we are talking about. Sometimes it is important to stop and think a bit about what we read.

If any of you have read Stuart Chase on the "Tyranny of Words" I think you will appreciate what I am trying to say to you. He points out that at the Tower of Babel, the Lord brought down upon the people the curse of the heterogeneous hodge-podge of language—the curse of many tongues, so that they did not understand each other. But, in addition to that, we have, within a single language, different meanings given to words by different people; and thus we have no common language within the English language unless there is a meeting of minds, as the lawyers say, so that we really know what we are talking about.

Now, in this matter of silicosis, there are a number of words that are used that we in Wisconsin have come to object to very, very strongly. One is the word "progression" of silicosis. We recognize that the disease develops, and that in exceptional cases it does progress aside from those cases that are not continually exposed. But we have not seen progression during the course of eight or 10 years among those individuals who had the ordinary exposure such as you see in foundries, in iron mines, and in ceramic plants. I think the granite workers are in a class by themselves, and I am not including them in this statement.

But this matter of progression to me is very important, and it is to all of us. We back up our statements by autopsy findings. I have had the privilege, myself, and I have the films of some 1500 cases of silicotics, almost all of them stereoscopic films. I have examined upward of 300 iron miners, men who in working in the mines had to go through the foot-walls of quartzite rock and silicious slate in order to reach the hematite bodies. And I have seen the tissues and some of the autopsies in many of these cases.

I very much regret that Dr. Norbert Enzer, the pathologist who has seen most of these cases, is not present today. I expected he would give us his very exact information on that subject.

The progress of the nodular silicotic that we see—and I say this in spite of the opinions that I have heard expressed by Dr. Ornstein—is not what has been called "third-stage" in many parts of the country. We have real good reason, pathological reason, to think that there is no such thing as a third-stage silicosis in the absence of infection.

Brumfiel and Gardner have pointed out the patho-

logical difficulties in differentiation. Gardner says that in many cases it is a matter of a pattern, the pathological pattern—not the individual slide, the study of the tissue itself, but the pattern of the lung as a whole that gives the clue.

The question of the presence of the tubercle bacillus is a very difficult one to demonstrate, but we will stand on the proposition, on pathological evidence, that the so-called third-stage silicotic is an infected silicotic.

We see the second stage cases go on under exposure for seven and eight years without any disability, without any slowing up in their work. I have seen them in the mines with 3-, 4-, and 5-mm. nodules climbing ladders and doing just as heavy a day's work as any others. But let them once begin to conglomerate and you will find that you have tuberculosis to deal with. And we can prove it on the autopsy records.

DR. B. R. ROGERS (Chicago): I have a feeling that it is the desire of this organization to have all the evidence that may apparently have a bearing on primary infections. All of us in this room over 50 years of age, all employees in the plants you represent over 50 years of age, were babies prior to pasteurization of milk, prior to the discovery of tuberculosis in 1890 by Koch. Thirty-five years ago I was a government inspector in the packing houses. When the old cows came up from the farms of Wisconsin—they were in the milkshed of Milwaukee and Chicago—animal after animal in rows of 20 would be found rotten reservoirs of tuberculosis. What we condemned there as cooked meat had been out on the farm for perhaps five or 10 years.

A few cows in the neighborhood of Milwaukee could have infected that large percentage of primary infections. A good many people believe that the primary infection of tuberculosis is in baby- and child-hood, or in the milk-drinking period, and that it may lie dormant. Then, when they go into occupations, it becomes not an occupational disease but a personal disease.

I want to mention something else about the progress of the Federal Department of Agriculture in the eradication of this bovine tuberculosis. I have been in packing houses when as high as four million tubercular hogs came in, in a single year. The hogs were associated with the cows on the farm. And over a short way from them, were so many adults and babies.

In the 3,000 counties of this country, the Federal Department has now reduced the tuberculin reaction in the cattle, in all but 40 counties, to less than one-half of 1%.

So, as the years go by, there is a factor that must be taken into consideration in postgraduate decline because the babies today are not living in the bad old days that some of these tuberculous people who are now adults did. I hardly ever see a tubercular animal in packing house work today.

DR. SANDER (closing): I should like to say two things. One is that we recognize that silicosis alone, of course, is a disease entity, but also we feel more and more that silico-tuberculosis is an entirely separate disease entity from silicosis or tuberculosis alone.

The other is that in our attempt to differentiate between ordinary tuberculosis in industry and industrial tuberculosis chargeable to industry, we feel that only by statistical work among large groups can we come to a final and definite conclusion. However, there is need of more uniformity of interpretation and tabulation among investigators in this field if their pooled statistics are to be of any value. Unless all unite on precise definitions of "clinically active tuberculosis" or "pathologically active silico-tuberculosis without clinical evidence of activity," the resulting conclusions will be meaningless.

The Employability of the Silicotic

VOYTA WRABETZ,
Chairman, Industrial Commission of Wisconsin,
Madison

THE recent review and appraisal of silicosis conducted by the Federal Department of Labor and studies of the same subject by various state legislatures and commissions, have focused renewed public attention upon the subject of occupational disease, particularly silicosis. Much has been done to clear the air concerning a subject into which confusion and almost an element of mystery have been injected. The problem of silicosis has not deserved the dilatory treatment and the rather fearful attitude which have been assumed by employers, insurance carriers and various legislative and administrative bodies.

A consideration of the problem of silicosis discloses the fact that the problem is not so much the determination of the method and amount of compensation payments, but rather the determination of the question of the employability of the silicotic. This latter determination depends on many elements. It embraces not only an historical study of the disease and its many concurrent and complicating diseases, but also includes consideration of the many necessary administrative problems which always arise. Involved are the subjects of engineering control, medical control, and administrative control by governmental bodies themselves, whether they be courts or commissions empowered to award or deny compensatory relief.

The discussion of the subject as to its importance in industry in this country need take us back only a very few years. Even today, but a few states have seen fit to compensate for silicosis as an occupational disease and, in many others, common law rules practically exclude recovery for disabling silicosis in courts of law.

It is most unfortunate that a disease so definitely and truly occupational as silicosis became important as an economic problem in this country during the depths of the depression with its wide-spread unemployment. At that time, engineers and medical men were still at sea, not only as to the harmful particle size, but also as to the dosage or concentration likely to cause pulmonary fibrosis.

A great flow of literature on this subject has poured forth during the last 10 years. Some of it shows informed and well considered study and research. Some is based on conjecture and fear. We still hear fishwives' tales about the causes and effects of this pathological condition. But we are learning to discriminate and beginning to see that there are certain rather well-defined and reliable principles that may be postulated, that can lead

us out of the maze of ignorance and fear in which we have been wandering.

Medical men in all fields—internists, radiologists, heart specialists and pathologists—have now had a sufficient number of silicotics under their care and observation so that standards of diagnosis have become rather uniformly fixed. The time has come when administrative bodies, competent for their task, can justly administer occupational disease laws.

IT IS no wonder that the employability of workers already known to have had exposure to silica, or with known silicotic fibrosis, even though slight, became a bugbear problem for employers having a possible silica hazard in their plants. Knowing that men with no abnormal physical signs and able to work, but with x-ray shadows coupled with the history of silica exposure, were frequently awarded huge sums by injuries, and even by administrative bodies or commissions, employers should not be too severely criticized for their defensive employment practices involving silicotics, when we take into account the fact that they were faced with possible financial embarrassment or economic extinction because of this single problem.

The dark clouds are lifting, now, and showing an enlightened horizon. The pioneering work of such outstanding engineers as Professor Drinker of Harvard, Donald Cummings and others, and such outstanding medical authorities as Dr. R. R. Sayers of the United States Public Health Service, Dr. L. U. Gardner and his staff at Saranac Lake, Dr. A. J. Lanza, medical director of the Metropolitan Life Insurance Company, together with the recent research work of Dr. O. A. Sander and Dr. Norbert Enzer of Milwaukee, and Dr. M. A. Seevers of the University of Wisconsin, is now recognized as scientifically accurate, and, above all, as practical.

Wisconsin has, as most of you know, compensated all occupational diseases since 1919. It has done so under the same type of law and with use of the same kind of procedure as applies to the administration of compensation for accidental injuries. Since the inclusion of occupational disease, about 2½% of all payments have gone for compensation and medical benefits for such diseases. Because of depression conditions, a much larger amount per year has been paid than will ever be paid in the future. This was because of the factors of so-called accrued liability and overliberality in settlement, and because of lack of knowledge and early hysteria on the part of employers, insurance carriers, doctors and the Industrial Commission. Had the true status as to the employability of silicotics been known earlier, the problem would have been even simpler than it has proved to be in Wisconsin.

IN CONSIDERATION of this subject, we must first of all define our terms. What do we mean by silicosis, and what do we mean by employability?

If we will recognize that silicosis, in its various manifestations, ranges all the way from a fairly innocuous condition to a disease fraught with dire consequences, we shall learn that we must classify silicosis into grades, or degrees, not necessarily sharply defined or limited. We must recognize that different stages of the condition must be treated, medically and economically, in different ways; that some silicosis may well be practically disregarded from both aspects; and that other manifestations must be treated with skillful discrimination and respect. We must learn that the study is not one which can be concluded briefly, or which is susceptible to a few simple rules, but that we must always rely upon the true medical scientists and the engineers who have been willing to give sufficient intelligent thought to the subject to reach accurate and practical conclusions.

The subject is particularly one of medicine and engineering and, when legal aspects are involved, we must bear that in mind primarily. Laymen must not reach too definite opinions or conclusions on a few hours or weeks of desultory reading of the various articles and books which have been written on it. Too much poorly digested material has been handed to us, it seems to me, sometimes with painful results.

When we consider the employability of the silicotic, we must examine the position of both employer and employee with great care. We must consider not alone the social, but also the economic aspects which present themselves, and we must do so with fairness and justice to both of the interested parties.

What is needed, more than anything else, is education as to the cause and nature of silicosis. Only recently an employer told me that he could not hire a man with silicosis because he did not believe it fair to other employees to hire a man with a communicable disease. Another employer actually believed that silicosis is a form of tuberculosis. So long as such misapprehension exists, our problem of employability will not be solved.

We must all appreciate that silicosis is a slowly developing thing and that, in low concentration of dust, an employee may go through a lifetime of exposure without recognizable clinical symptoms. We must learn that, although idiosyncrasy of the individual may play some part, it is an almost negligible factor and that the course of silicosis in the large run of cases is quite uniform and predictable. We must learn that high concentrations of deleterious dust with no protection to the worker are capable of causing comparatively rapid development, but that such development, even under bad conditions, is generally a matter of years and not of months. We must appreciate that with proper safeguards and efficient dust removing devices, the worker is almost as safe in a dusty trade as he is when walking on the streets. We are all exposed to the breathing of some siliceous dust, no matter what our environment may be.

If all silica hazards now existing could instantly be eradicated by the waving of a magic wand, our problem would be simple. Our objective must be

to decrease the exposure to deleterious dust sufficiently so that even a working lifetime of exposure will not cause disabling damage. This objective is practical and obtainable, and its cost, spread like the cost of machinery and equipment over years, should be not unduly burdensome. However, even though burdensome, it is wholly necessary, even from a purely economic standpoint. Training of new men for skilled trades is expensive. It is cheaper for the employer to clean up and keep his men at work than to cast them aside and undergo the expense of turnover, training and those intangible results of unrest and antagonism which are created by a more or less wholesale discharge of workers who appear to be, and usually are, able to continue at their tasks.

While speaking of this objection, may I pause for a brief observation with respect to its consummation? Wisconsin has, or, more truly, has had, a silicosis hazard. We have iron, lead and zinc mines involving driving through siliceous rock, a large granite industry with its known silica exposures, many foundries, both large and small, ceramic plants and other factories and processes in which the use of silica is a factor. Because of both a social and an economic urge, our industries have performed almost a miracle, by various means of removing dust, in reducing the amount of silica in the breathing zones of workers to relatively safe concentrations. The romantic story of these accomplishments might properly be entitled "The Slaying of the Giant Silica" or some such heroic title. But that is another story and is mentioned here only because, together with a consideration of what is to be done *now* with the silicotic, it is the other important factor in the ultimate solution of the entire silicosis problem. To date, all those who are interested, and who know what must be done and what is being done, are happy in contemplation of the future. We congratulate those far-sighted employers who are doing things, and take just pride in their boast that, while it is costing something to make places of employment safe, they can proudly exclaim: "We are not killing men."

WHEN cases of silicosis first came to the attention of the Industrial Commission of Wisconsin for decisions on compensation claims, it was the prevailing medical opinion that even the earliest recognizable lung changes caused a measurable impairment of lung function. At our commission hearings on such cases we were hearing figures of 10% to 25% disability for first stage cases, 25% to 75% disability for second stage cases, etc. In many instances, these figures were pure guess work on the part of the examining physicians. In other cases they were computed from rough exercise tests, or vital capacity determinations which, it now is generally believed by physiologically-minded medical men, are quite unreliable for this purpose because of the necessity of absolute cooperation on the part of the person being examined and for many other reasons too numerous to mention at this time. Our commission, however, as well as others, made many awards in those early days based on such partial disability estimates improperly arrived at.

As a result of this prevailing medical thought, employers began examining prospective employees before hiring. In order to "play safe," many, who lacked a far-sighted point of view, began refusing employment to any persons whose x-ray films showed anything except perfectly clear lungs. Many doctors making such examinations were advising old employees to discontinue the only trades they knew, although their x-ray films showed only slight deviations from the normal. We have on record one employer who refused employment in his foundry to any person showing such negligible x-ray changes as small adhesions at the diaphragm, and healed childhood infection scars, as well as to those who gave histories of bronchitis and pneumonia, and those who showed the slightest degrees of lung fibrosis. As a result of such rigid rules, he was forced to examine eight men for every one accepted for work. Since he hired over 100 new men for his foundry in 1933, it can be seen what havoc was raised by the rejection of over 700 applicants for work. If all other foundry employers in Wisconsin had followed the same procedure that year, a serious situation undoubtedly would have resulted. It was fortunate that the large majority had a much more sane viewpoint and had not instructed their doctors to do such unnecessary weeding out. Some rejected men found work elsewhere, but many others naturally filed claims for compensation. It is needless to add that 1933 and 1934 were our busiest years in adjusting silicosis claims, and that in those two years alone practically half of all claims that we have had through the years were adjusted. Over half of the claims which were filed during those two years were disallowed on the grounds that no disability had been proved. In perhaps one-third of the total cases in these two years, workers filed claims in the search of needed income—often times not because their claims had real merit, but because they had been misinformed.

We, on the commission, soon realized that a program of education was necessary, not only for ourselves, but for doctors as well who were interested in this problem. Their opinions expressed at hearing were at such wide variance that it was next to impossible to decide what was the true state of affairs between two extremes. Accordingly, we sponsored a symposium on silicosis, which was held here in Chicago in November, 1932. At that meeting, we invited six or seven recognized authorities on the subject to speak and we invited many physicians, industrialists and representatives of insurance companies to attend and participate. In 1934 all the members of our commission, the director of our workmen's compensation division, and our engineer in charge of dusts and fumes control, as well as a representative of the Attorney General's department, attended the first symposium on silicosis at Saranac Lake, New York, and heard the opinions of other authorities on the amount of silicosis necessary

before the person affected developed disability. The subject is one which particularly calls for the services of the expert, and the knowledge we have acquired from the true scientists in this work has, I believe, done much to bring order out of chaos and, therefore, to eliminate unwarranted confusion.

The general examination program in the dusty trades in Wisconsin has been going on for nearly six years. Most physicians who are making examinations have not only *not* turned old employees out of their regular jobs because of early silicosis, but actually have permitted new employees to be hired who already had x-ray evidence of uncomplicated silicosis. Their only rigid rule for rejection has been that those with active tuberculosis are not permitted to continue their work. Obviously such a rule is necessary, not only for the afflicted person so as to bring him under early treatment, but even more as a protection for his fellow employees. It is because (and almost solely because) of these active tuberculosis cases, which are not discovered unless examined, that examinations of dusty trade workers are necessary and must continue.

WHAT of the worker who has silicosis in its early stages? Is it safe to keep him at work? Will he develop disability? Will he develop superimposed tuberculosis?

In Wisconsin we continually see workers who have reached the age of 40 or 50 years who have worked for 20 or 30 years in massive concentrations of silica dust and who are doing hard manual labor every day with no appreciable slowing down, of efficiency. However, remembering that silicosis is a developing condition, especially if heavy exposure continues, what should be our procedure? By all means we should keep the man at the work in which he is happy and skilled and in which he has often earned comparatively high wages. If we discharge him, we shall not arrest the progress of his condition. Even with a considerable future exposure only a few drops will be added to a bucket of lifetime acquisition. If we reduce the exposure to recognizable safe limits, we need have no doubt as to our course. We shall do the worker and the industry a much greater injustice by firing him than by leaving him at work.

We have, therefore, provided in the Wisconsin Workmen's Compensation Law, that an employer who discharges an employee who has a non-disabling silicosis and who can safely be retained in the particular employment, shall be liable for an amount (not exceeding $3,500) to rehabilitate such an employee. This provision is designed to discourage the promiscuous discharge of silicotics who are fully able to work.

However, we must never overlook the fact that silicosis does pre-dispose to tuberculosis, and that is true of all stages which have reached the point where they may be designated as a disease. So, in justice to any worker in any trade which involves exposure to silica, we must examine his lungs by x-ray and, if necessary, by other means of examination, to know whether tuberculosis is present. There can be no question as to our course when tuberculosis is discovered. Manifestly, the worker so afflicted is not employable anywhere until his disease is arrested and, obviously, he must never again enter a trade which exposes him to an appreciable amount of silica.

It is also necessary to deny work involving dust exposure to those with inactive but not well-healed tuberculosis. All authorities agree than non-dusty work will give these tuberculous persons a much better chance of thoroughly healing their infection. Others being rejected are those with advanced degrees of silicosis who already have recognizable disability. This whole group of those who are being advised to do only non-dusty work constitutes, I am told, not more than 2% of otherwise employable workers. The employees with early degrees of simple silicosis are permitted, by most of our examining doctors, to continue their regular work.

That this conservative procedure was the proper one is proved by the steadily declining number of claims for silicosis coming before our commission since that time and by the resulting steady decrease in the compensation insurance rates in our dusty trades. During the years 1933 and 1934, as high as 50 silicosis claims were filed in a single month. For the past 18 months an average of only six claims has been filed.

It can be observed that most of these are cases of infected silicosis many of which have been under observation for many years and in which the infection antedated the examination program. Many of these cases have reached the point now where it is advisable to have the men discontinue employment in order to institute treatment to accomplish a cure of the infections.

Certainly there is no reason for excluding the silicotic worker from employment with no silica exposure, provided that his condition is an uncomplicated one. Just as certainly he need not be excluded from dusty trades where his silicosis has reached an early stage only after years of exposure, provided future exposure is reduced to the point attainable by practical equipment.

FURTHER proof that the silicotic individual is employable if no complicating infection occurs is furnished by the numerous reports of periodic clinical surveys now being published in increasing numbers. Most of these observers are finding that those who had uncomplicated silicosis in the early days of the examination program are showing on changes even four or five years later. Not only is silicosis in such workers not progressing to any appreciable degree, but the vast majority do not seem to be developing complicating tuberculosis. One such report for foundry workers in Wisconsin was published in last month's *American Journal of Public Health* by Dr. O. A. Sander, of Wisconsin. Among over 4,000 foundry workers who have been examined periodically, the conclusion was reached that most cases of silicosis with tuberculosis are reactivations of a previously acquired but walled-

off tuberculosis. In that paper, proof is given than a man over 50 years of age with uncomplicated silicosis runs very little risk of ever acquiring a superimposed tuberculosis. Moreover, his working efficiency does not seem to be impaired even though his x-ray film manifests nodular shadows. He is practically as safe a man to employ as others of the same age.

Research laboratory studies are still further confirming these conclusions. Dr. William McCann and his associates at the University of Rochester, New York, have done some admirable work along this line. By actual measurements, they are finding no appreciable diminution of lung capacity until the silicotic changes are advanced or associated with considerable tuberculosis or emphysema. In other words, the early stages of uncomplicated silicosis do not seem to cause any significant impairment of lung function. This being true, there remains little doubt but that the person with early silicosis is as employable as are others in the same age group without silicosis.

In the proceedings of the National Silicosis Conference sponsored by the Federal Department of Labor in 1937, it was drawn as a final conclusion that those silicotics who are completely or totally disabled because of silicosis *and* whose difficulties are further complicated by tuberculosis, should be removed from employment. It was estimated that of the 49,000,000 workers in the United States, only 1,000,000 (2%) are in any way exposed to the hazard of silicosis. Perhaps half of this number, 500,000 (1% of the total) are exposed to a serious hazard. Approximately 110,000 (0.2 of 1% of the total) have silicosis in some degree, but it is likely that the number of workers who suffer any occupational disablement at this time from this disease is about four to five thousand. From a purely statistical point of view, therefore, the problem of silicosis is not as serious or general as some other industrial problems, such as lead poisonings and industrial accidents.

The committee concluded that the percentage of the four to five thousand workers, completely or partially disabled because of silicosis plus tuberculosis, should be removed from employment; that the remainder of the four to five thousand workers who have silicosis and disability in some degree, but no tuberculosis, should, in the majority of cases, continue at work. The comment is made that every study conducted thus far confirms the fact that the great majority of these men will not necessarily progress from bad to worse, and that these men should be continued at their old work under proper dust control methods. Obviously, all workers should guard against exposure to tuberculosis, and those with dust in their lungs should be especially careful in this regard. That is as true of the man who has been exposed for only a brief period of time as of the worker who has been subjected to long exposure.

In the placement of employees, special consideration should be given to control of the dust to which they are exposed. No employee should be required to work on a job where the dust cannot be controlled. Almost without exception dust control devices and methods are available for practically every operation. It scarcely seems necessary to mention that no one, no matter how good his lungs, should be exposed to excessive quantities of silica dust without some type of respiratory protection. This extra caution is particularly advisable when placing men who already have some silicotic fibrosis.

THE question of uniformity of interpretation of lung changes warrants discussion because of the many physicians in our industrial communities who now are making pre-employment and periodic examinations. In general, it may be stated that the less experience a physician has had with this problem, the more rigid will be his weeding-out. He will reject many applicants for employment whom others with more experience in this field will pass without hesitation. A situation thus is created whereby the applicant's chance of securing his job depends on the experience of the doctor to whom he is sent.

A uniformity of interpretation seems necessary among doctors making these examinations. The fear of unjust discrimination among employees required to take medical examinations must also be allayed. Therefore, the Wisconsin Industrial Commission has taken steps to bring about standard practice and procedure with respect to medical examinations and the use of medical reports, by the appointment of a committee of physicians who are acquainted with the problem. We are hoping that the recommendations agreed upon will have a far-reaching effect in standardizing examination procedure in the dusty trades. That they will discourage the rejection of the person with uncomplicated silicosis we are certain.

Wisconsin's experience has taught that silicosis is by no means the serious problem which many persons believe it to be. States which have not adopted coverage for occupational disease should set their fears at rest with the realization that if the problem is approached with the exercise of common sense and careful study and that if men are kept at work and examined periodically for complications, the cost will not be out of line with the cost of accidental injury, nor the problem one of undue difficulty.

To those employers who are unwilling to assume any burden of occupational disease, I have nothing to say. Their position runs contrary to the general acceptance of workmen's compensation principles. They are willing to expose their worker, but are not willing to pay the result of exposure. Compensation principles have become so well established that their soundness is hardly debatable at this time. To those employers who are willing to assume a reasonable cost of the result of occupational disease as they do of accidental injury, who are willing to clean up their establishments and to install dust-removing equipment and methods, I say hire and continue in employment the silicotic as you hire any other employee with a slight physical defect. Examine him to see whether he is af-

flicted with tuberculosis. Unless complication is found on examination, the employee will probably cost you no more in compensation than if you discharge a large number of employees because of trivial lung findings. Add the cost of turnover, training, and morale of the worker, and if the ledger does not wholly balance the cost which can be charged to the exercise of a sound humanitarian principle, that cost will, indeed be small. We can be certain that workers will rightly demand protection for their fellows who are exposed to the silica hazard and compensation for those who become disabled because of it. The trend for decent protection of employees and for compensation for industrial workers, undoubtedly will progress to embrace all physical conditions resulting from accident or disease caused by industrial hazard. We are faced with a condition and not with a theory. The employer who early realizes that the cost must be assumed will recognize the economy of proceeding along rational lines. He will profit by careful study and intelligent handling of a problem which is by no means insurmountable, and in which most of the pioneering work has already been done. When he realizes the fact that the silicotic is employable in the vast majority of cases, he will keep such workers employed under proper supervision and conditions. The continued employment of such workers together with the control of silica concentration will cause the ghost of silicosis to disappear into thin air, as it already has to a good degree in Wisconsin.

President's Address: Health Promotion in Industry

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MODERN conditions have brought new problems into industrial hygiene. These have come about chiefly through the development of new industries and the invention of new processes, the increasing size of factories, improved and changed methods of transportation, specialization and crowding in cities and workplaces, changing relations between capital and labor, and the tempo and pressure of our time. The strides which have been made in the conduct of industry have, however, accomplished much in the improvement of health and safety for the worker, and there is no doubt that the average employee lives and works today under conditions conducive to longer life and better health. However, we still have a long way to go if we are to more than postpone mortality and prevent sickness, i.e., if we are to take to our working population the positive side of health—namely, the increase of vitality, capacity and efficiency of the human body.

With the advent of the industrial era, there was a decided increase in the number of employees in workshops, which caused a gradual disappearance in the personal relationship between employer and employee; and what is more important, the newness and crudeness of the machinery used and the lack of proper safeguards, as well as ignorance concerning the poisonous nature of certain materials, created a decided increase in the number of accidents and occupational diseases. In these formative years, the burden of the consequences of industrial health hazards was borne usually by the worker himself, but early in the 18th Century steps were taken to protect workers and to relieve them of this burden. If we look back upon the early history of industrial medicine, we will find that the main function of medical departments in industry was the repair of injuries, which called primarily for surgical care. Owing to the stimulus of legislation enacted for the protection of the health and safety of many of our workers, and also to the growing personal interest of employers in the welfare of their employees, the functions of the medical department began to extend beyond surgical treatment to the medical phases of the problem. Such matters as physical examinations, job placement, and more recently, medical and engineering control of occupational health hazards, began to take their place in industry. Where in the past attention was paid mainly to the improvement of machinery, now attention has been directed to the economic waste resulting from the failure to provide protection against controllable health hazards.

In other words, industry has become more and more aware of the importance of prevention, realizing that the conservation of the worker's health was not only socially desirable, but also economically sound.

One of the primary stimuli to the introduction of medical services in industry has been the passage of workmen's compensation laws for accidents and occupational diseases. Today 46 states have workmen's compensation laws providing benefits in the event of accidental injury, and 21 of these states have enacted legislation compensating workers for occupational diseases. If we are to interpret the trend of our times and be prepared for further legislation, I believe that it is essential to give some consideration to the ever-increasingly important problem of general illness among our workers. This viewpoint is desirable because recent studies indicate that the so-called ordinary diseases of life are far more important than specific occupational diseases. In view of this, it appears to be appropriate to take inventory of the entire industrial health problem in this country, our progress in coping with it to date, and what might be accomplished towards solving it in the immediate future.

I understand that precedent gives the President of this Association the privilege of selecting the subject and title for his address. For a title I have deliberately chosen "Health Promotion in Industry," promotion signifying more than mere conservation, maintenance, or preservation of health. Our aim should be not only to oppose disease but also to advance and develop physical fitness and well-being. To achieve such aims, we must pay attention to the whole life of man, embracing, as it does, all of the conditions making for a maximum degree of personal health.

The Problem Today

INDUSTRIAL hygiene aims to promote the health of workers. Industrial hygiene so defined would necessarily evolve a program extending beyond the prevention of accidents and occupational diseases, and embracing all gainful workers. It is obvious that some of the problems arise from the nature of the industrial environment itself—namely, the control of poisons, dusts, excessive temperatures and humidities, defective lighting, noise, overcrowding, and general plant sanitation. They also involve such factors as hours of work, fatigue, communicable diseases in the factory, mental health, and personal hygiene. In the past, industrial hygienists have concentrated their efforts on the so-called industrial population in this country, namely, the 15 million workers employed in manufacturing, mechanical and mineral industries. However, if we are to accept the definition of the present discussion, it is obvious that we are dealing with a larger percentage of our population, since, according to the last Federal census, there were approximately 49 million persons gainfully employed, and all of these should come within the scope of industrial health programs.

Although it is true that the major occupational diseases occur in the manufacturing, mechanical, and mineral industries, nevertheless such gainful pursuits as agriculture with 10 million workers, transportation and communication with more than four million persons, domestic and personal services with approximately five million workers—all of these employments have health problems which should be receiving attention. What makes the problem somewhat more difficult is the fact that the majority of our workers are employed in small units, which at present have no practical means of furnishing adequate industrial health services to their employees. For example, of the more than eight million persons employed in manufacturing plants alone, approximately half are found in factories with less than 250 workers.

That the industrial health problem is especially important is indicated by accumulated data that show the existence of a greater mortality rate in the industrial population than in the whole group of gainfully employed persons. Moreover, excess mortality is notable among unskilled workers, among whom the death rate from all causes in certain states was found to be 100% in excess of the death rate among agricultural workers. Studies of illness in industry made by the United States Public Health Service also show high rates. For example, the incidence of such diseases as tuberculosis, pneumonia and degenerative conditions was found to be higher in the industrial population than the average. There is evidence to justify the opinion that tuberculosis deaths can be reduced 50% by health supervision of workers in occupations predisposing to the disease, by detection of early cases, and by provision of adequate medical and institutional care of the cases discovered. It is also known that pneumonia mortality and disability are excessive among workers exposed to sudden changes in temperature, inclement weather, toxic gases, and dusts.

In considering the improvement of the health of our workers, we find that we are confronted with a four-fold problem. To the layman, accidents bulk large in his view of industrial disability, and in spite of the fact that great strides have been made during the past 20 years in the prevention of accidents, this form of injury still constitutes an important problem. According to the last preliminary report of the National Safety Council, there were 19,000 occupational deaths in 1937.[1] Studies also indicate that we have not approached minimum rates, since the records for accidents in certain steel companies with best practices show a far lower rate than for the industry as a whole.[2] Moreover, it is well known that certain occupations, aside from the so-called "dangerous trades," are associated with poisoning, disease, and high mortality. In the third place, many of our workers in early adult life are found to lack the physical capacity and mental stamina to undertake certain types of work. And lastly, we have come to realize for some time that we have far too much absence from work on account of sickness or fatigue, or other incapacitation due to a complex set of factors, some of which are no doubt controllable. While accidents, occupational diseases and high occupational death rates appear to be impressive, there is no doubt that the least dramatic side of the problem is probably far the most important—namely, the lost time and incapacity due to illness. It is this last condition that is so widely prevalent as to be almost universal in all localities, at all ages, in all occupations. Here we have a vast amount of wasted energy and life due in the main to preventable illnesses, some of which no doubt may be contributed by the working environment. Although we have made significant progress in the control of certain communicable diseases, as is evidenced by the declining trend of our death rate in the last 40 years, we must not lose sight of the fact that this saving of life has taken place chiefly in childhood and in the years of early adult life. No significant increase has appeared to occur during this period in the average years of life remaining to persons of middle and advanced age. The death rates from some important diseases of adult life have been increasing, a phenomenon understandable in the light of the fact that the principal causes of death operating in the advanced years are primarily chronic. Preliminary data from the National Health Survey, based on surveyed persons of all ages, show that chronic diseases, in-

cluding permanent impairments, alone account for six of the 10 days of incapacity from illness and accidents experienced by the average person per year;[3] and with respect to sickness and accidents, data to be published by the Division of Industrial Hygiene show in the instance of a public utility that on the average 7.5 days were lost annually by males and 10.9 by females.

All of these facts have an important bearing on the industrial health problem, since here we are dealing with an adult population. It would appear, therefore, that we must accomplish for our adult disease problem what we have achieved in recent years in infant and child hygiene, and industrial groups appear to offer one of the most logical points of approach.

In other words, we must take public health to the factory as well as to the home.

Present Trends in Industrial Hygiene

GOVERNMENT responsibility for safeguarding the health of our workers rests chiefly with state and local departments. The agencies of the Federal government concerned with industrial hygiene are primarily engaged in the collection and dissemination of information, conducting field studies, laboratory research, and protection of the health of Federal employees. Prior to 1936 most states dealt chiefly with matters of safety, sanitation, employment of women and children, and compensation of employees following accidents. Administratively, the states have placed enforcement of occupational disease legislation in various departments. However, if we accept the definition of industrial health given earlier in this discussion, we must realize that industrial hygiene is an important public health function.

During the past two years the United States Public Health Service, through the Division of Industrial Hygiene, has assisted in the development of this field in state and local health departments.

This development has been stimulated in part by funds allotted to the various states for public health activities by the provisions of the Social Security Act.

Today there are 23 states and four municipal departments of health that have taken steps to provide industrial health services. It must be remembered, however, that many of these units are but recently established and will not be in a position to render adequate service to industry and labor until they have greatly increased financial support and increased trained personnel.

With the exception of the activities in the Federal government, and possibly to a limited extent in industry, the industrial hygiene divisions in our states and cities are confining their work to the evaluation and control of occupational diseases in industry. Statistics for the prevalence of occupational diseases are available for only a few states, since it must be borne in mind that the principle of compensating for an occupational disease is of recent origin in this country. In Wisconsin a workmen's compensation law, including the compensation of occupational diseases, has been in operation since 1919; some recent unpublished data based on the Wisconsin experience and furnished by Doctor Gafafer of this Division bear examination. For the 16-year period from 1920 to 1935, occupational diseases accounted for 2% of the total compensated cases. During 1935 this percentage was 2.83. During the same 16-year period 2.8% of the total costs for all injuries was due to occupational diseases, but during 1935 the corresponding percentage was 7.06. The compensation cases settled in 1935 represented a loss of over two million working days, and of these days lost, 8% were accounted for by occupational diseases. In other words, although the incidence of occupational diseases and costs appear to be rising, they still constitute but a small percentage of total compensated cases and costs occurring in the State of Wisconsin. Reports from other states, such as New York, New Jersey and Ohio, show a similar trend. According to the United States Department of Labor, the total direct and indirect costs of industrial injuries in this country are approximately five billion dollars annually, and of this amount, occupational diseases accounted for but a small percentage.

On the other hand, studies made by the American College of Surgeons indicate that illness causes at least six times as much absenteeism as do industrial injuries.[4] It is apparent that the time and monetary losses due to general illness must, indeed, be staggering. Although we have no comparable statistics to show the costs, in this country, for the so-called general illnesses in the industrial population, individual studies do show that were such statistics available they would definitely indicate that these costs are far in excess of occupational disease and accident expenditures. In fact, data cited by the Committee on the Costs of Medical care indicate an expenditure of approximately 10 billion dollars annually for illness.[5]

It would seem, therefore, that if we are to improve the general health status of the most important and numerous group in our population, it will be necessary not only to control unhealthful conditions in the working environment, but also to give consideration to such factors as proper living conditions, elimination of strain and hurry, and anxiety due to economic insecurity, communicable diseases—in fact, as stated earlier, a general adult hygiene program for our workers is required.

A Suggested Program

PERHAPS the first step for management to consider is the development of a viewpoint on the entire subject. Industry has shown so well what it can do in the development of a new machine or a new process, once it has been convinced of the value of the particular machine or process under consideration. It seems to me that if a similar technique were followed with reference to industrial health programs, like successful results should follow. I know of no better example of the excellent progress which can be made through concerted efforts than the splendid achievement in the control of accidents in American industry in the last 20 years. I see no reason why similar progress

should not be possible in the field of other health hazards in industry.

Once this viewpoint has been developed the next step should be a survey of existing practices in this field of preventive medicine. We need more information on standard procedure, although I believe that there is a certain amount of standard practice concerning medical care of industrial workers. I wish to call to your attention the excellent studies which have been conducted by such organizations as the National Industrial Conference Board and the American College of Surgeons. Our own Dr. Selby is a pioneer in this field, having made one of the first—if not the first—survey of this type more than 20 years ago. As a result of these studies, we do have some ideas as to what constitutes a medical program. However, it is our feeling that in order to make effective progress in this field, it is necessary to have a complete industrial health maintenance service. Such a complete service would have personnel from the medical, engineering, statistical, nursing and chemical professions.

As indicated earlier, one of the first steps in such a program would be a study of existing conditions in the industry under consideration. The technique employed in such studies is indeed no different from the general public health principles with reference to the study of other health conditions. Let us assume that the industry under consideration happens to be that concerned with the manufacture of chemicals. The first step would be a preliminary plant survey by the medical, engineering and chemical personnel to reveal the potential hazards in the industry. To conduct such a preliminary plant survey would necessitate the development of simple forms, some of which have been published by the United States Public Health Service.[6] Time does not allow me to present a complete analysis of the data which may be obtained from such a study, but it will show the extent to the workers of such facilities as accident hazard control, first aid, medical and nursing services, engineering control of occupational diseases, and the extent of the keeping of records for accidents and illness.

Such studies also indicate the specific occupational exposure to various health hazards, either of a chemical, biological or physical nature, and an idea of the control measures now in practice for each hazard.

It is at once apparent that such data are indispensable in a control program.

The next step in the program is the evaluation of the working environment in its relation to the health of the workers themselves. Here again the medical, engineering and chemical professions play an important role, and I should like to present for your consideration the results of one study which has been made in the past by the Public Health Service.[7]

A recent study of the hatters' fur cutting industry showed that the principal occupational health hazard to which employees were exposed was mercury vapor and mercury-impregnated dust. In this industry fur to be used in the manufacture of felt hats was prepared from the pelts of hares and rabbits.

At an early stage in the manufacturing process, a solution containing mercury is applied to the pelts, forming, apparently, unstable chemical compounds with constituents of the fur. At every subsequent stage in the manufacturing process mercury vapor is given off. The medical studies showed that approximately 8% of all employees could be diagnosed as having chronic mercurialism. The symptoms on which greatest weight was laid in making the diagnosis were fine intention tremor, exaggerated forms of psychic irritability, gingivitis, other types of oral pathology, coppery discoloration of the mucous membranes of the mouth and throat, and certain characteristic neurological and vaso-motor disturbances. The incidence of mercurialism was greatest in the occupations in which exposure to mercury vapor and mercury-impregnated dust was greatest; this makes it seem reasonable to suppose that a reduction of mercury concentration by the introduction of engineering control methods would result in a reduction of the health hazard. Engineering and chemical studies showed that these workers were exposed to from .6 to 7.3 mg. of mercury per 10 cubic meters of air, and that by the methods of segregation and local exhaust ventilation the occupational exposure to mercury could be reduced to less than 2 milligrams per 10 cubic meters. Medical studies also showed that apparently there was no great incidence of mercurialism with an exposure of less than 2 milligrams per 10 cubic meters. In other words, this study showed that it was possible to control the hazard in this country by methods already employed in some of the plants producing hatters' fur.

This is but one of the many examples from our own studies which demonstrate the procedure in evaluating and controlling certain health hazards in industry.

IN GENERAL, once the hazards are evaluated by medical, engineering and chemical means, the next step is obviously the control of those conditions found to be, or suspected of being, inimical to health. The basic objectives of a medical control program embrace the following activities: (1) to estimate by examination the physical and mental fitness of employees for work; (2) to maintain and improve the health and efficiency of those already employed; (3) to educate the worker in accident prevention and personal hygiene; and (4) to reduce absenteeism from illness and injury. These objectives necessarily involve a wide variety of activities and may be best worked out for each individual plant depending upon local conditions.

We are gradually accumulating a formidable amount of basic engineering data in the control of accidents and occupational diseases. In general, the following methods have been found of value in controlling certain health hazards by engineering methods: (1) substitution; (2) isolation; (3) wet methods; (4) local exhaust ventilation; (5) respiratory protection.

The protection of workers against certain ma-

terials known to be toxic may at times be accomplished by the substitution of a non-toxic substance for the toxic one. For example, the use of a metallic or other type of artificial abrasive for sand in the sand blasting process, in those operations in which it is not essential to use sand—a substance high in quartz—has not only resulted in a great decrease in the dust concentration but is also definitely associated with practically no exposure to quartz dust. With reference to isolation or mechanical inclosure of certain processes, an excellent example of this type of protection is that of the modern sand blasting barrel used in the cleaning of small objects. Although the use of wet methods is limited to dust producing operations, this procedure has been found efficacious in many industries. In rock drilling and loading, it has been possible to reduce the dust concentration from more than 500 million particles to less than 30 million particles per cubic foot of air. However, the most effective method of control today is that of local exhaust ventilation, provided it is properly designed and adequately maintained. The literature today is replete with many examples of the reduction in exposure to hazardous materials which has been effected by this type of control. And finally, it is often necessary to resort to respiratory protective devices, such as gas masks, respirators, air supply masks and helmets, and similar devices.

Once the problem in an industry has been evaluated by medical and engineering means and everything possible has been done to control the health hazards revealed by such studies, it will still be essential for the medical and engineering personnel to maintain constant vigilance in order that conditions may be maintained safely and improved upon, if at all possible. Constant study of the workroom environment by actual quantitative determinations is essential to ascertain whether certain measures are really effective.

Such practice, coupled with the physician's supervision over the health of the worker, appears to afford the best means of eradicating industrial health hazards.

I have mentioned earlier the necessity for determining the extent of illness among our workers and the importance of this problem in the entire picture of industrial health. This is not really a new idea to industry, since a number of establishments have realized the value of keeping adequate sickness records. However, even among those concerns keeping such records, there is very little uniformity, and frequently essential information is lacking.

A knowledge of absenteeism with respect to frequency, duration and cause, in each numerically important occupational group in an industry, or a factory, serves to reveal to those responsible for the industrial health program the type of action which should be taken to obtain a maximum reduction in the amount of time lost from work on account of disability. In the absence of such information it is impossible to estimate the relative importance of sickness problems in need of attention. For example, the incidence of pneumonia may be abnormally high in some occupational group, but this situation may be undiscovered for years when the number of cases occurring in the group is not related to the population exposed. When such sickness rates are available for specific diseases by occupation, the effect on health of certain environmental conditions may be measured and evaluated.

Such data also enable one to judge the effectiveness of control methods for diseases occurring with excessive frequency.

I should like to illustrate the value of adequate records of morbidity and mortality from a study made several years ago by the Public Health Service concerning the pneumonia problem in the steel industry.[8] During the period 1922-1928 it was found that the pneumonia case rate in the steel industry was nearly 70% above the rate in public utilities and approximately 50% higher than the rate for a group of other reporting industries. Among industrial workers generally one may expect an average pneumonia rate of 2.5 to 3.0 cases per year per 1,000 men; for steel the average was 4.4 cases per 1,000 male members of the reporting sick benefit associations. This result is the more striking on account of the low morbidity rates for nearly all of the major causes of illness among steel workers, which is suggestive of a favorable position of the men from a physical standpoint in the industry. Ruling out such factors as the pneumonia mortality in iron and steel manufacturing centers, seasonal variation in frequency of the disease, influenza epidemics, economic status, age of the men, their nationality, extent of addiction to alcoholic stimulants, etc., by measurement and evaluation, we still found that an excessive amount of pneumonia existed in certain departments of the steel plant under study. Analysis of the cases per 1,000 men showed the frequency of respiratory diseases by department, and once again an abnormal frequency of pneumonia was recorded.

These rates constituted the basis for a detailed study of working conditions in the mills which might predispose to pneumonia or certain other diseases of the respiratory system.

It is apparent that without such statistics as a guide it would not have been possible to trace down and eliminate some of the causes of this excessively high pneumonia rate.

TIME does not allow me to discuss the work of the industrial nurse in industry nor to devote much time to the need for a well-equipped research and routine laboratory. Studies of the industrial environment necessitate numerous laboratory examination, both of a medical and chemical nature. These call for biochemists and chemists of highly trained type. Today, with the added use of chemicals in many of our processes, and with the employment of old and new chemicals in industry, some of which are hazardous to health, there is a great need for data concerning the toxic effects of these substances. The proper procedure, of course, is a study of these new materials or pro-

cesses on a pilot scale prior to their widespread use in industry.

There should be a close collaboration between the production and development department and the industrial hygiene division.

The benefits of a health conservation program in industry are often difficult to demonstrate. This is especially true when dealing with the general health of workers, and in some measure with certain occupational diseases, such as silicosis, which take so long to develop. However, in dealing with accidents and with certain poisonous materials, it is relatively simple to demonstrate quickly the salubrious results obtained by control measures. It is also difficult because of the lack of sufficient data to indicate the economic benefits resulting from a health program in industry. In an endeavor to ascertain how much money an industrial organization can afford to spend for the prevention of disability from sickness and accidents, and for the treatment of minor illnesses and injuries among its employees, Brundage, of the Public Health Service, reviewed the trend in occupational accident rates in this country during recent years, as well as the rates of disabling sickness among the employees of a few corporations which maintained adequate morbidity records[9]. An important item in calculating profitable expenditure for health and accident prevention is the extent of reduction in disability frequency and time-lost rates which may be achieved through medical and engineering control of industrial health hazards. Brundage's analysis of available data showed that from a modest reduction of sickness and accident rates the total savings to employer and employee may be expected to be approximately $20,000 a year per 1,000 employees. This reduction was for industrial concerns having accident rates considerably below the average for industries covered by workmen's compensation laws and where the number of illnesses attributable to occupational health hazards was negligible. Obviously, where industrial accidents or disabling illnesses occur, at average or above average frequency, an expenditure larger than that indicated above for health and safety work is warranted. Brundage also estimated that in order to maintain an adequate industrial hygiene unit consisting of medical, engineering, chemical and nursing personnel, an expenditure of $10 to $12 per capita per year should be adequate.

Thus, it would seem that from an estimated minimum profitable expenditure of $20,000 per year per 1,000 employees for health conservation, a balance of $10,000 per year per 1,000 workers would be left for maintenance of protective equipment and for amortization of the capital expenditures required.

I realize that expressing health and life in terms of monetary units may be sordid; nevertheless, it affords a conception of the relative importance of certain problems in terms of well understood values, and quite often a realistic approach to the health problems in industry results in progress. It has been said that the most notable advances which were made in the safety movement were not inspired by humanitarian motives, but by the discovery that safety devices were cheaper in the long run than accidents.

I have attempted to depict the problem of industrial health in its entirety, indicating its magnitude, its importance and the progress we have made in coping with it, and have endeavored to chart a course for the future in order that we may effectively keep abreast of the times. I have no doubt whatsoever concerning the advisability of extending our present activities to include the important problem of adult health. A knowledge of absenteeism with respect to frequency, duration and cause in each numerically important occupational group in an industry or a factory serves to reveal to the management the type of action which should be taken to obtain the maximum reduction in the amount of time lost from work on account of disability. It is this loss of time which is so important, both from a humanitarian and an economic viewpoint. In my opinion the situation calls for leadership, and I know of no better organization to furnish this leadership than our own. No group, in my opinion, is better fitted to formulate and carry through a comprehensive program than this group of Industrial Physicians and Surgeons, with its long experience and traditions in this field. I think we shall have taken a forward step if our Association would seriously consider the appointment of a committee to study during the coming year the problems associated with absenteeism and to develop the standard forms required for their solution. I wish to assure you that the Division of Industrial Hygiene of the United States Public Health Service will be glad to cooperate with such a committee in order that we may all have the necessary basic knowledge leading to the solution of the industrial health problem.

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Syphilis in Industry

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IT APPEARS paradoxical that a disease so long known as syphilis should present itself as rather a new problem in industry. And still, if we analyze the situation, we find that only in the past year has it appeared as a disease in which industry is called upon to take a definite stand.

The nation-wide campaign to stamp out syphilis has attracted the attention of people individually and collectively. Industry as a most important unit of our national economy, has been alert to see where it could participate in this great work as a benefit to the workers and thereby to itself. The excellent presentation of the problem of syphilis in the newspapers and magazines and on the air, has made it easy to convince the industrialists that much can be done to further this great humanitarian movement. This is one of the reasons why I had no difficulty in instituting a program at the plants with which I am connected.

The industrial physician is in a rather unique position in syphilis control programs because of his relationship with the worker, the plant officials and the private physicians and clinics. A syphilis control program that is well carried out cannot but help to bring these groups closer together. It has done so in my experience. The private physician often looks at the industrial physician with fear that he will lure patients away from him. It is the duty of the plant physician to keep workers in good physical condition and therefore he must be constantly on the lookout for pathological conditions. The plant physician is not permitted to treat conditions that are not traceable to occupation or accidents, and he therefore, *must* refer workers to their private physicians for the correction of defects. Very few of these cases would otherwise reach the family physician until symptoms interfered with their livelihood. In the case of syphilis, the plant physician acts as a case finder for the private physician. He attempts no treatment, but refers all cases to the private physician for treatment.

When a worker is diagnosed as having syphilis, he is greatly in need of a friend who will give him proper advice and guidance. If the procedure is attempted by the private physician alone, the worker is likely to think, because the treatment is long and expensive, that he is not being properly used. The plant physician can and does advise the worker that the treatment of syphilis requires time and money and that the private physician is doing the right thing. Too many patients lapse from treatment because they are not sufficiently informed as to what constitutes adequate treatment.

The control of syphilis was formerly considered a matter of treatment. Now that the treatment of syphilis has been developed to its present state of efficiency, we have also realized that there is another important adjunct in control, and that is in proper education. Most people who contract the disease do so because of ignorance. The prostitute was formerly considered to be the principal source of infection, and although she still does much in spreading the disease, there are too many other unsuspected sources. We have too often heard the stock expression in clinics that "she looked like a nice girl." Such statements are an index of the prevailing ignorance on the subject of venereal disease. It should add emphasis to the educational program on the control of venereal diseases.

In order to carry out a successful health campaign, it is very necessary that education be made a principal factor in the program. The progress that has come about in serology and chemotherapy makes it important that physicians be included in this educational process. This at present is going forward in the medical press and at meetings of medical societies. Fortunately the cinema has made it possible to get together a talking film by some of the world's greatest men in this field. It would not be possible to have all these important men together at one meeting; however, their views are well presented by these talking pictures. I would urge that medical societies consider the use of this means of hearing these men and observing the demonstrations that are available in this method. The film is available from several sources. The State Department of Health in a number of states will show the film on invitation from the medical groups.

There are several films available from these same sources that are suitable for the lay public. These are well prepared and presented in a way that will disseminate information, and they are not offensive to even the most prudish person.

The workers in the plants with which I am associated have been reached by the use of articles on venereal diseases in our plant journal, posters are displayed in conspicuous places in the plants, and literature has been distributed. It is gratifying that this educational process has been received enthusiastically by the workers. The workers in Peoria have exhibited their eagerness to learn of venereal diseases to the extent that they arranged a mass meeting at which they heard city, state, and Federal health authorities, as well as Dr. Kahn who has come to be known to all workers as a great crusader in the control of syphilis. The workers invited various organizations, students, and the people of Peoria to come and share in their educational meeting.

DR. ALBERT RUSSELL, of the Public Health Service, informs us that there are 40,000 deaths every year from syphilitic heart disease. Records from the country's leading clinics show that 65% of the patients appearing with this con-

dition do not know that they have syphilis. Each death represents a loss of 19 to 23 years of life—call it 850,000 years of life expectancy lost. Many of these are trained industrial workers. There are 4,500 deaths each year from paresis (syphilis of the brain), and another 1,100 deaths from tabes dorsalis (syphilis of the spinal cord). These two account for another 100,000 years of life expectancy. Child deaths from congenital syphilis bring the figure well past the million mark.

These are merely lives. One can translate them into dollars by figuring the loss in productive power. Life expectancy is money, and money is the thing of which insurance premiums are made.

Syphilis is a disease of the young. Most infections start between the ages of 15 and 30. The disease has a long course, usually fatal in from 10 to 25 years, in middle life. This period of illness and death from ages 25 to 50, is the one that is important to industry, inasmuch as it represents the most productive period of a man's life.

The living cost is a great deal more than the dead. In state institutions we care for 18,700 cases of general paralysis. In all institutions, public and private, there are beds for 43,000 syphilitic mental and nervous cases. If all of these cases are cared for at the $2-a-day rate, which is the average for public institutions, the annual cost would be more than $31,000,000. There are more than 8,000 new admissions being made to these institutions every year. This sad stage of the syphilitic means that not enough of our medical care goes into proper treatment in the early stages of syphilis. Proper early care would be the cheapest thing to do with syphilis. Wisconsin started a syphilis control program 20 years ago, and at that time 12% of the insanity in that state was due to syphilis. This has been reduced to less than 4%. This program is saving the state millions of dollars in the domiciliary care alone of the hopelessly insane due to syphilis. Wisconsin has gone about as far as she can until all the other states join her in the program of eliminating syphilis.

The cost of treating a case of early syphilis from infection to cure would be somewhere between $50 and $600, depending upon whether it was done by the mass methods of a public clinic or by a high-priced specialist. Apply an average cost of $100 even to your 1,100,000 annual cases of syphilis, and the result is $110,000,000. A conservative estimate of the cost of institutional care of the syphilitic blind has been estimated at $10,000,000. America's 160,000 syphilitic heart disease patients are not ordinarily hospitalized, and the cost of their care cannot be easily estimated; neither can the cost of home care for any of the other groups. Industry shares the greater load of the taxes for the care of these unfortunate syphilitics, whose sad plight could have been so easily prevented with proper treatment.

BEFORE any plan for the employability of individuals afflicted with syphilis can be approved by industry, there are numerous angles which must be considered, and the conditions must be satisfactory not only to industry, but to the employee himself, the insurance carriers, fellow-employees, family physician, and the health authorities.

It is our opinion that we have such a plan at the present time, which we will first submit, and then discuss its effect on the above-named individuals.

The plan at present in use at the Caterpillar Tractor Company, and which has been functioning for the past 18 months, is briefly as follows:

The individual, following his interview with the personnel and employment departments, is submitted to the medical department for a complete physical examination, which includes a routine Kahn test and urinalysis, as well as any blood studies which may be required. Incidentally, it may be mentioned here that the Caterpillar Tractor Company maintains its own laboratory with a licensed technician, and functions with the approval of the Illinois State Board of Health. If, following the examination, the Kahn test is found to be positive, the individual is given a personal interview with either the medical director or the plant physician, and he is informed that the blood test was found to show evidence of syphilis, and that he should present himself immediately to his family physician for a re-check, the resultant report to be submitted to the medical department. In our experience it has been found that practically all cases so re-checked, are found to be positive.

The individual is then told that this information is absolutely confidential between himself and the physician, and that absolutely no information has been given to the employment or personnel departments. This in my opinion is very essential, and upon this factor alone depends the success or failure of the plan. If the individual is given absolute assurance that his condition is not public knowledge, and that he is to be given the opportunity to correct himself physically he is grateful rather than resentful.

This individual is then told that if he presents himself to his family physician for treatment and continues treatment, he will be given employment as long as he continues to cooperate. Every six months a check is made with the family physician to ascertain the number of treatments, and to determine the cooperation of the individual with his physician during that period. If the report is favorable, the individual continues with his work and continues his treatment. Following the termination of treatment the individual is asked to return every six months for a Kahn test.

The operation of this plan is dependent upon the type of syphilis that presents itself in the individual. The individuals in the primary or secondary stages, of course, are rejected, and also those who have definite evidence of neurosyphilis, to the degree that they are partially disabled at the time of their examination.

During the past 18 months, our records disclose examinations on approximately 10,000 men, with a positive Kahn in 4%, and only in two instances have we found individuals who have failed to cooperate in the treatment to the extent that we were forced to deny further employment. It might

be stated at this time that, of all the employees examined, only 25 were of the negro race. This is mentioned merely for the benefit of statistical information.

WE NOW can consider the effect of this plan on the various individuals concerned in its operation. The employer benefits by the fact that the cases of syphilis in his organization are known cases and are under continuous observation and treatment, thus making these individuals certainly less of an accident hazard; their proficient workmanship is improved; and there is less lost time, with an eventual elimination of mental hazards, total disabilities, and replacements. The employee naturally receives the greatest amount of benefit from this plan, inasmuch as he is able to continue his occupation, and is able to support his family, and to pay for the treatments necessary for the ultimate favorable termination of his case.

There may be a question raised at this time concerning the welfare of fellow-employees. But after all, in organizations in which the syphilitics are *unknown*, the hazard is much greater to the fellow-employee — not only from an accident standpoint, but also from the possibility of transmission, as we all know that cases under treatment are less likely to be infectious than are those which receive no treatment at all.

It has been brought to my attention that in some instances there has been some objection by the insurance carriers to this particular plan; but to me it would seem that the insurance carriers certainly would profit from a plan of this type, as opposed to any other arrangement in which there is no plan of control. In this respect we often find serious complications in accidents to syphilitics, and since under most of the compensation acts an exaggeration of a pre-existing condition is compensable, the ultimate payments are therefore increased by the presence of syphilis. In an organization where there is a control of these conditions, there is less possibility of complications, with a positive reduction of the lost time period and specific loss, and even in some cases fewer death benefits.

Certainly there can be no objections to this plan by the family physician, inasmuch as the cases are referred to him for treatment, and the only thing asked of him is his cooperation in maintaining the treatment for the proper period of time.

Recently there was brought to our attention by the United States Public Health Department the matter of the improper reporting of these cases to the proper authorities and the lack of a check-up on the family of the individual afflicted. It is our opinion that this responsibility rests not with industry, but with the family physician. It becomes his duty to report the case, and also to protect the family of the patient.

The most alarming situation which has presented itself within the past 18 months is the deplorable lack of knowledge found among physicians attempting to treat syphilis. Not in a few, but in many, instances, individuals have been given a course of treatment for three to four months and then informed by their family physician that they have received all the treatment necessary for the cure of their disease. We are of the opinion that treatment should be continuous over a period of at least 70 weeks, after which time the individual should be repeatedly checked by Kahn tests at intervals for the remainder of his life.

THE plan submitted in this paper for the control of syphilis in industry is not claimed to be perfect, but we hope that by constructive criticism and experience further additions may be made toward making it more perfect, with resultant greater benefits to all individuals concerned. The least that can be said is that it is humanitarian, with benefits to the employer and to the employee, as well as to the insurance carriers. It has impressed us with the thought that we are faced with a problem of education of the public as to the seriousness of the disease, and certainly with the education of the physician in the proper treatment of the disease.

The conquest of syphilis rightly must be the next great objective in public health. Industry can and will do its share in carrying out this program and is in a position to reach about half of the population of the United States through the workers and members of their families. Industry will cooperate with the local, state, and Federal health authorities and the medical associations to this end. The history of medical progress shows instance after instance where the combination of medical and public health facilities has conquered disease so far as public cooperation could be procured. The general educational program has brought such a generous response that it appears that public cooperation is not only assured but also that the people are demanding that syphilis be conquered. The combination of the efforts of physician, public health officials, educators, and the public, will conquer this great killer.

Syphilis control in industry will make for greater efficiency, it will save money, and it will remove much discomfort and discontent, but the major benefit is that it will make the lives of Americans more healthful and more secure.

Discussion:

DR. A. E. RUSSELL (U. S. Public Health Service): A few things come to my mind about which I might speak. First is the educational program. Dr. Vonachen has done an excellent job of syphilis control in industry in Peoria. The reason he has been able to do it is because Mr. Heacock, the splendid man at the head of his concern, was educated as to the necessity of syphilis control. Also, Dr. Vonachen, himself, was so educated, and he knew which way to proceed.

I feel in carrying the program of syphilis control forward not only in industry but also in general, that education is our keynote. When people understand the great significance of syphilis, whether in industry or elsewhere, they are immediately fired with enthusiasm to do something about it.

In response to the possible inference that industry has not done its share, I think that if you compare what industry is doing and what it is planning to do with what the general population is doing about syphilis, industry

is doing its share. And I believe that with the extension of this program, and with improvement of industrial conditions, industry will do much more about the control of syphilis. It is very much to its advantage to do so, in making its workers better and more efficient.

You all know of incidents where industries have been public-minded. They have gone ahead with the community to support institutions and make the life of the community better. I believe if syphilis didn't concern industry any more than that, they would be interested in the program from that angle alone.

An interesting point about the syphilis program in industry is the fact that if a worker is assured that his job is not in jeopardy, he will cooperate whole-heartedly in the syphilis program. Dr. Vonachen has given you a good example of that. I know of an industry that refuses employment to people with syphilis, and, as a result, practically no persons who know they have syphilis will make application there. When they started physical examinations in that plant, 7% of the applicants had syphilis. The policy just mentioned has been in effect for a number of years, and now less than 2% of their applicants have syphilis. That does not mean that applicants have less syphilis, but merely that they are not applying for work in this plant.

Dr. Vonachen said that the person with syphilis is the person who needs a friend. That certainly is true. Many intelligent people would not know what to do if they realized they had syphilis, and that is where the physician is certainly "the friend of mankind." To advise a person what to do about personal hygiene, about his family, and about the continuation of treatment is certainly an important function of the physician, whether he is in industry or elsewhere.

As you know too well there is a lot of unemployment. We are looking for better times, and as better times come there will be a lot of re-employment. It seems that a good time to check on a large group of industrial people would be in the re-employment program. I know of certain industries that have planned, in making re-employment examinations, to include tests for syphilis. Where cases are found to be positive, these industries intend to re-employ them providing they are not infectious or have no signs of injury to the nervous system, and provided the worker in each instance agrees to take treatment.

Dr. Vonachen mentioned the extension of this program to the families. Syphilis control is like tuberculosis control. It is not a one-man proposition. It is a movement in which the whole community is interested and must cooperate. The industrial physician, cooperating with the family physician and with the health department, can and will be a great factor in carrying syphilis control to the general population.

There are about 15 million industrial workers in the mechanical, mining and mineral industries in this country. If we estimate four persons to a family, that group of workers would represent approximately half our population. With industry taking the initiative in carrying the syphilis-education program to the workers, and with the program further carried out by the health departments and by the family physicians, the necessary education in this respect should reach 60 millions of our people. I believe that with the coming years and with better times industry will do its part in helping to reach at least that half our population on syphilis control.

DR. IRVING GRAY: May I ask Dr. Vonachen whether they examine their old employees to determine whether there are any new cases?

DR. EDWARD C. HOLMBLAD: I have the opportunity at this time to present a resolution that was passed by the Board of Directors last evening. I think we are very much in sympathy with that employee who has been unfortunate enough to acquire syphilis, not knowing it, and then have his condition found out, and himself discharged. Employers who discharge employees because they are found to have syphilis, we believe are doing a very definite injustice to such employees. There are many specific instances on record in recent times which show that too many employers have a phobia which requires them to discharge employees as soon as they know they have syphilis.

Therefore, the resolution:

"WHEREAS, we hereby approve the program against syphilis as initiated and carried on by the Surgeon-General of the United States Public Health Service;

"BE IT RESOLVED, That we strongly recommend that any employee found to have syphilis should not be deprived of his employment as long as he is not infectious, not disabled, and pursues proper treatment."

[DR. HOLMBLAD then moved the acceptance of this resolution, and his motion was seconded, put to a vote, and unanimously carried.]

DR. VONACHEN: In answer to Dr. Gray, fortunately our campaign was started when our employment was rather low so that we have covered, perhaps, 75% of our employees. We have a plan in our plant that if a man is absent from work over a period of one week, he must report for a physical examination before he returns to his job. With the aid of that plan we have covered a number of men we failed to find in the first instance.

We have not gone through our plant and attempted to get all of them. We feel that it might cause just a little dissension if we were to try that. Eventually, of course, we will discover them.

Regarding the treatment of syphilis, I think we all know that throughout the United States there are free clinics. For instance, in the city of Peoria with a population of 150,000, we have four clinics that are maintained by the city, the U. S. Public Health Service and the State Board of Health. I don't believe there is anybody in this country today who is being deprived of treatment for syphilis because of inability to pay. Furthermore, there are probably more receiving free treatment than there are coming to their family physicians.

Tuberculosis in Industry

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BEFORE discussing tuberculosis in industry, one must be familiar with the mortality of the disease in the various ages, the racial groups, the sexes, and under different economic conditions. Without such knowledge, false conclusions may be drawn as to the frequency of the disease in any industry. An example of the above was the finding of an unusually high incidence of tuberculosis in an industry in a small town in New York State. On careful investigation, it was found that most of the people employed came from a section of the town which had the highest death rate in tuberculosis. Inasmuch as there was nothing in the industry which could be regarded as a competent reason for the finding of so large a number of tuberculous cases, it was logical to assume that the high incidence was not due to the industry but due to the fact that most of the people

employed came from the district in which the annual death rate was the highest. We therefore must consider the effect of sex, age, race, and economic conditions on the tuberculous mortality.

SEX: Although on the whole there is greater mortality in males than females in the United States, there is a variation in the death rates at different ages. Before the age of 10, the mortality is greater among boys than girls. From 10 to 30 years, the pendulum swings over to the female, and from 30 years on, the male death rate is always greater than the female. Taking the 84,741 deaths in the United States Registration Area in 1930, Drolet[1] pointed out that on an average in that year, the male death rate exceeded the female death rate by nearly 17%, whereas in New York City the excess in male death rate was much higher, namely, 35%.

AGE: Age has a considerable influence on the mortality of tuberculosis, and varies considerably in the sexes. The following figures were taken from the Tuberculosis Mortality by Sex and Age, United States Registration Area, 1930, as computed by G. D. Drolet from the figures of J. S. Whitney, National Tuberculosis Association:

	Rate per 100,000		
Age	Both Sexes	Male	Female
15-19	55	40	71
20-24	101	84	116
25-29	107	99	115
30-34	100	107	93
35-39	94	107	80
40-44	94	115	71
45-49	95	122	66
50-54	94	123	63
55-59	97	125	67
60-64	98	124	71
65-69	110	130	89
70-74	116	133	98
75+	109	114	104

We note from the above figures that from 15 to 30 years there is quite an excess of deaths in the female compared to the male, and from then on the higher death rate is in the male group. More important than the difference in the rates in the two sexes are the death rates at the various ages. When analyzing the death rate in industry, it is most important to find the various age groups and compare the death rate with the usual death rate at that age—for example, the death rate in the industries associated with silica dust which are credited with the largest tuberculous mortality. Let me quote the figures of Lanza and Childs,[3] 230 per 100,000. The common age for this group is between 40 and 75 years of age. The average tuberculosis death rate for the above age group is about 92.5 per 100,000. Should we deduct the 92.5 from the 230 per 100,000 or should we credit the industry with the total death rate for that age?

RACIAL GROUPS: It is not my intention to discuss the racial factors in tuberculosis from the standpoint of environment, that is, economic conditions versus racial constitutional deficiencies in resistance to tuberculosis. I personally am inclined to the former concept which has been previously published (Ornstein[4]). The incidence of tuberculosis in industry must have a direct relationship to those racial groups in whom the death rate is often five times as great as in the white race. The Negroes and Mexicans are such examples. Probably one of the most important factors influencing tuberculosis mortality is the economic condition of the worker. In the past we have associated poverty—poor housing, bad hygienic conditions, etc.—with the high death rate in tuberculosis. And after all, are not poverty, poor housing, bad hygienic conditions, etc., merely an expression of small earning capacity? In this group, the tuberculosis death rate is increased and indirectly reflects itself in industry.

In a study of the tuberculosis death rate in men gainfully occupied, between the ages of 15 and 64, Whitney[5] found the following:

	Rates per 100,000
Professional Men	26.2
Proprietors, Managers, and Officials	43.2
Clerks, and Kindred Workers	65.8
Agricultural Workers	46.5
Skilled Workers and Foremen	72.1
Semi-skilled Workers	98 2
Unskilled Workers	182.0

The death rate among the unskilled workers is more than twice that of the skilled workers. Is this due to the industry or to the limited earning capacity? It is more probably due to the latter. Limited earning capacity has a direct relationship to tuberculosis in industry.

Incidence of Tuberculosis in Industry

IN RECENT years there has been some speculation as to the incidence of tuberculosis in industry. It is not uncommon to hear it said that the incidence of tuberculosis in industry is about 2%. There has not been sufficient investigation to corroborate such a high incidence. To my knowledge, there have been only a few investigations that throw some light on the frequency of tuberculosis in specialized fields of employment. Before discussing them, we must decide whether we are to discuss the incidence of clinical pulmonary tuberculosis or evidence of manifest pulmonary disease diagnosed by x-ray and interpreted as tuberculosis. There is a wide variation between the incidences of the one or the other. In a food handlers' group of 2,000 men and women investigated by Martin, Pessar and Goldberg,[6] the incidence of clinical pulmonary tuberculosis was 2.3%, whereas the x-ray manifestation of pulmonary tuberculosis was 11.9%. Both figures are high. In an investigation of 7,722 miners in the lead and zinc mines of the Pitcher field of the Tri-State District (Oklahoma, Kansas, and Missouri), Merriwether, Sayers and Lanza[7] report an incidence of 3.4% in 1928 and 2.6% in 1929. In most instances the diagnosis was made by x-ray alone, and as there was a possibility of confusion because of a high incidence of silicosis, the percentage of tuberculosis may be too high.

Barnard[8] in an x-ray survey of the people on Home Relief in two large districts in the City of New York found an x-ray incidence of pulmonary tuberculosis of 12.3% in one group and 9.8% in

the other. The group in the Harlem district consisted of 10,232 people out of whom 1,254 had x-ray manifestation of pulmonary tuberculosis. Of the 10,000 x-rayed in Brooklyn, there were 976 cases or 9.8%. In the Harlem group, the people were almost all Negro or Porto Rican. The Brooklyn group lived under almost similar conditions as the people in Harlem. The age was 10 years or over. Out of the 2,200 cases reported 2.7% had definite tuberculosis, 3% were suspected, and 5.4% were diagnosed as healed. The sum total of these is 11.1%. The investigation is a good example of the importance of dividing incidence into x-ray and clinical pulmonary tuberculosis. The incidence by x-ray in this group was 11.1%. The incidence of clinical pulmonary tuberculosis was 2.7%. These figures are almost the same as the ones reported by Martin, Pessar and Goldberg. Out of 2,000 food handlers, 11.9% had x-ray evidence of pulmonary tuberculosis and 2.3% had clinical pulmonary tuberculosis. The incidence (the Home Relief Group) occurred in a group of people in whom the mortality is from four to six times that of the city as a whole.

Ulmar, Ornstein and Epstein[9], on x-raying 1,000 colored nurses applying for positions at Sea View Hospital, found an x-ray incidence of 1%. Out of the 10 cases, two did not accept the positions offered. Seven of the 10 have worked continuously with no x-ray change or showed evidence of resolution of their lesions, and one broke down. These 1,000 members of the colored race have a different economic status, and naturally there is a marked difference between the 11.1% (x-ray) in the Home Relief group and the 1% (x-ray) in the selected group of nurses.

In sharp contrast are the investigations of Bashford and Scott[10] who found for 1935 1.04 cases of tuberculosis per 1,000 employees in a group of 121,000 men and 35,000 women in the English Post Office system. This is about 0.104%, a very low incidence. Bashford and Scott state that the incidence from 1920 to 1935 was a trifle under or over the incidence reported for the whole population of England and Wales.

Compared to the foregoing figures, the incidence of active pulmonary tuberculosis is much lower when we attempt to calculate this from the mortality figures, as has been practiced by the Committee on Administrative Practice of the American Public Health Association. This Committee assumes there are two new cases reported during a given year for each death and a total of five cases of clinical tuberculosis on a given day in a community to each one death occurring during the year (Drolet[11]). Whitney's[5] figures can be utilized in estimating the incidence of clinical tuberculosis in industry. In 100,000 males gainfully occupied, from 15 to 64 years of age, in selected industries the tuberculosis mortality is 87.5. The 87.5 multiplied by 5 is the number of active clinical cases of pulmonary tuberculosis in this group (437.5 per 100,000) which is about 0.437%. Taking the highest mortality figures reported in this group of gainfully occupied males in selected occupations, the calculated incidence is much lower than the actual findings of incidence in the food handler's group. Factory and building construction laborers had a mortality of 227.3 per 100,000 which is only 1.136%, a low incidence compared to the 2.3% in food handlers and the 3.49 and 2.6% in the miners described above. To state that 2% is the incidence of clinical tuberculosis in all industry, is probably placing the figure too high. The incidence in industry as seen from the foregoing must depend a great deal on the economic status of the groups employed. When labor is drawn from a group in whom the tuberculosis mortality is four to six times as great as that of the country as a whole, the incidence of tuberculosis will be between 2 to 3% and will be proportionally lower under better economic situations.

Tuberculosis as an Occupational Disease

THERE has been a great deal of confusion in terms when discussing the question of compensation for tuberculosis arising out of employment. The confusion is in the term occupational disease. Is tuberculosis an occupational disease? Surely a disease with a specific etiology is difficult to associate with an industry. Would it not be just as difficult to associate syphilis directly with an industry.

Before discussing the few instances where we may consider tuberculosis as an occupational disease, let us define just what is meant by an occupational disease. An occupational disease must arise out of the occupation per se. There must be a definite relationship between the etiology of the disease and the occupation. The frequency of the occurrence of the disease in the occupation must be greater than the incidence of the disease in a similar age group of people not so associated.

With the above definition of occupational disease in mind, can tuberculosis be considered as an occupational disease? There are many pitfalls and opportunities for false conclusions. In the beginning of this paper it was pointed out how the frequency of tuberculosis in a particular industry was not due to the industry but to the recruiting of labor from a section of the city with a death rate four to six times that of the people of the whole city. In such a group, Barnard[8] has demonstrated an incidence of definite disease of 2.7%. Whitney[5] has pointed to the difference in the death rate between skilled, semi-skilled, and unskilled workers. The tuberculous death rate in unskilled workers is more than twice the death rate for either of the other two groups. The reason is obvious—unskilled labor comes chiefly from those parts of the city in which the death rate is four to six times the rate of the city as a whole and the incidence of clinical disease is from 2 to 3%. Frequency of the disease alone is not a sufficient factor to associate tuberculosis with an industry as an occupational disease. All the factors associated with tuberculosis which were previously discussed must be considered before condemning an industry as responsible for tuberculosis as an occupational disease.

There are a few definite instances where tuberculosis may be discussed as an occupational disease:

1. The development of tuberculosis in the workers caring for the tuberculous sick—nurses, orderlies, attendants, etc.

2. The occupations in which there are contacts with a large number of people in whom there may be a high incidence of tuberculous disease; for example, store clerks, saleswomen, waiters, conductors, etc.

3. Those trades in which there is continuous exposure to silica dusts; not that free silica in the dusts produces pulmonary tuberculosis, but because of the belief that the deposit of the silica in the lungs predisposes the lungs to infection by the tubercle bacillus.

Tuberculosis in the Hospital Worker in the Care of the Tuberculous Sick: In the care of the tuberculous sick there are many opportunities for cross-infection and the development of pulmonary tuberculosis. In recent years, the frequency of the occurrence of tuberculosis infection and disease among medical students and nurses has been noted. Heimbeck, of Oslo,[12] in 1933 reported that though 50% of the student nurses entering the Ulleval Hospital were tuberculin negative, at the end of the training period, 100% of this group reacted to tuberculin, thus demonstrating that in the course of their routine work tubercle bacilli had been planted into their bodies with the production of tubercle formation. Geer[28] demonstrated that though 65 to 70% of the student nurses entered training tuberculin negative, after the period of training on the tuberculosis service, 100% reacted to tuberculin. Meyers, Diehl and Lees[13] pointed out the greater frequency of tuberculin positive reactors in those hospitals in Minneapolis having tuberculosis services than in the hospitals without a tuberculosis service. At the end of the training, the positive reactors among the probationers in the former institutions was 100% in contrast to 14% to 40% in other hospitals.

The observations of the above mentioned investigators have been repeatedly confirmed and are similar to the experience of our group at the Metropolitan Hospital. There can be no question but that the opportunity for exogenous infection of the lungs by the tubercle bacilli presents itself in the care of the tuberculous sick, and usually happens as demonstrated by the foregoing investigations. Fortunately the 100% appearance of positive tuberculin reactors is evidence of tuberculous infection which is entirely different from tuberculous disease. From the above we may conclude the opportunities for exogenous tuberculous infection is greatly increased when working in a tuberculous hospital. Although the nurses employed at the Sea View Hospital are Negresses, the incidence of tuberculosis (examination of 1,000 nurses) was 1% by x-ray, a low incidence compared to the x-ray incidence of 12.3% of the people on Home Relief in the Harlem district of New York City (Barnard), a district populated by Negroes and Porto-Ricans. There have not been many studies on incidence of tuberculosis in nurses. At the Metropolitan Hospital, including nurses, attendants, and workers, we found an incidence in 1937 of about 6.5% by x-ray. The group was small, numbering only 150.

The important factor is not the incidence of tuberculous disease but the frequency of the occurrence of clinical tuberculosis among workers in a tuberculosis hospital. Shipman and Davis[14] reported between 6% and 7% occurrence of clinical tuberculosis in the student nurses in the University of California Hospital. Ross[15] reported that during the period of student training and up to one year after graduation, 6% of the nurses in Manitoba fell ill with tuberculosis. Jones[16] reported 3% of the girls in training became ill with pulmonary tuberculosis. In comparison with a similar age group of women in a teachers' training school, he found little tuberculosis. At Sea View Hospital, in the 1,000 nurses in whom we found an incidence of 1% x-ray evidence of pulmonary tuberculosis, during the period of 1930 to 1935, 21 nurses developed lesions in the lungs. The 10 cases found on the initial examination are not included in the 21 cases. Of the 21 cases who developed lesions while working in the hospital, four could be definitely grouped as the caseous pneumonic type. Two of these occurred within one year of the occupation, one within two years of the occupation, and one within five years. Seventeen developed infra-clavicular infiltrations or productive apical lesions. Nine occurred within one year of the occupation, three within three years, and two within five years. Of the 10 cases who showed evidence of pathology on admission, seven continued to work with either clearing or no change in the lesion, one broke down with a cavity, and two did not start work.

Similar studies have been made among medical students. Soper and Wilson,[17] and Hetherington, McPhedran, Landis and Opie[18] have tended to show the increased incidence of tuberculous diseases, presumably due to their occupation which throws them in contact with the open tuberculous cases.

The frequent occurrence of clinical tuberculosis among nurses as noted by the above group of investigators, with the knowledge of easy access to exogenous infection by tubercle bacilli on the tuberculosis wards (100% negative reactors to tuberculin becoming positive after service on the tuberculosis wards), complies with the definition of an occupational disease. The disease arises out of the occupation and is specifically associated with the etiology of the disease (exogenous infection by tubercle bacilli). The occurrence is more frequent than in a normal group of people at a similar age. The above applies to all workers in the care of the tuberculous sick.

The question of whether or not the occurrence of clinical tuberculosis should be regarded as an occupational disease in a general hospital is a debatable one. In a great many general hospitals, the frequency of implantation of tubercle bacilli

in the previously non-infected probationers has been almost as great as in the tuberculosis wards.

Many cases of open tuberculosis are admitted to the general hospital for surgical and other forms of treatment. The tuberculous disease is not suspected and the nurse takes no precautions against exogenous cross-infection while she attends the patient. The contact may be a continuous one without the tuberculous disease ever being discovered. The nurse later breaks down with the disease. In some general hospitals, there may be few or no tuberculous patients; in others, a good percentage of the patients may have the disease—for example, the general hospitals caring for the group in lower economic strata, where the death rate is four to six times that of the city, and the incidence of clinical tuberculosis is from 2 to 3%. To show that the above is not speculative, I refer to figures of Myers *et al.*[13] who pointed out that the negative tuberculin reactors among probationers at general hospitals without tuberculosis wards (in Minneapolis) varied from 14 to 40% positive reactors at the time of graduation. The question of whether the tuberculosis acquired in a general hospital is an occupational disease will depend a great deal upon the frequency of the admission of tuberculosis to the hospital.

Those Occupations in which there are Contacts with Large numbers of People in Whom There May be a High Incidence of Clinical Tuberculosis: The people involved in such an occupation are chiefly the clerks in stores, waiters, car conductors, fountain dispensers, etc. The presumption that the tuberculosis acquired in these occupations may be classed as occupational is based on the many opportunities for contact with open cases of pulmonary tuberculosis. Again there must be a wide variation in the opportunities of contact infection in districts with small or high incidence of clinical tuberculosis. Think of the possibility of such contact in the 5 and 10 cent stores in the Harlem or Brooklyn district investigated by Barnard. There are no definite figures as yet in such industry except that the general impression is that the occurrence is frequent. The industry is not recruited from the slum sections, and in some of the large cities the help comes from a good middle class where the incidence is not high.

Silicosis and Tuberculosis

IN THOSE trades in which there is an exposure to dusts containing free silica, there develops a disseminated fibrosis of the lungs called silicosis, which of itself is capable of causing disability. Silicosis is definitely an occupational disease. Silicosis is being discussed under tuberculosis as an occupational disease because of the belief that the deposit of silica in the lungs renders the lung susceptible to infection by tubercle bacilli. A great many investigators have associated silicosis with the occurrence of pulmonary tuberculosis, and even in the literature of this country there are very positive assertions concerning the frequent occurrence of tuberculosis with silicosis. In 1933, at a symposium on silicosis during the annual meeting of the National Tuberculosis Association at Toronto, Canada, tuberculosis was stressed as a common complication of silicosis. Lanza[19] stated: "It was well recognized that silicosis results fatally due to extraordinary susceptibility to tuberculosis which it induces." At the same meeting, Riddle[20] stated: "Tuberculosis is the commonest and most important complication in silicosis and is responsible for the majority of the deaths among silicotics." Gardner,[21] at this same meeting, went so far as to give actual figures as to the death rate of tuberculosis in silicosis. He said: "At least 75% of the victims die of a complicating tuberculosis infection." These investigators at that time did not present the material on which the quoted conclusions were determined. Recently Gardner[22] has retracted his statement that at least 75% of the victims die of complicating tuberculosis. He explains he had misinterpreted the statement of Dr. Irvine, Chairman of the Miners' Phthisis Medical Bureau at Johannesburg, who said: "A measure of the extent of predisposition to tuberculosis in cases of silicosis is afforded by the fact that of all the deaths that have occurred in the two groups mentioned below" (ante-primary and primary simple silicosis) "some 75% had been due directly to active tuberculosis." Gardner states: "To have interpreted these words to mean that 75% of persons with silicosis will ultimately die of tuberculosis is obviously an error." That 75% of the deaths in silicosis are caused by tuberculosis has been widely quoted.

The conclusions of the above-mentioned investigators have not been definitely proved. That most of the silicotics die of pulmonary tuberculosis is a debatable question. The positive opinions are based upon vital statistics, and inasmuch as the advanced stages of silicosis and pulmonary tuberculosis have so many common characteristics, there is a tendency to make mistakes in diagnosis. The symptoms, the physical findings, the x-ray, have characteristics common to both diseases. In the advanced stages of silicosis with poor pulmonary efficiency, the disease is usually incorrectly diagnosed as pulmonary tuberculosis. The absence of the tubercle bacilli in the sputum is ignored because of a peculiar belief that has been accepted by a large number of investigators, that patients may die of pulmonary tuberculosis without the presence of tubercle bacilli. In a discussion at the Third Symposium on Silicosis associated with the Trudeau School regarding the frequency of the absence of tubercle bacilli in silico-tuberculosis, Gardner[23] said: "that he did not actually know but the proof seemed indisputable that the number of organisms was decreased in old cases of long standing. He cited four siderosilicotic cases which on autopsy had shown typical gross and microscopic manifestations of associated tuberculosis with large cavities. The contents of the latter had been removed in test-tubes at the time of postmortem examination and sent in for guinea pig inoculation. Two animals were in-

jected with each specimen and none of them had exhibited any evidence of infection. Even the diagnostic tuberculin reactions were negative in these animals. These observations proved that the organisms which had once been alive and produced the tuberculosis in the sidero-silicotic lungs had subsequently died. That these were not exceptional cases was indicated by the paucity or absence of tubercle bacilli in stained sections of the lungs of all such lesions and by the tendency for tuberculosis to heal in experimental sidero-silicosis. All of the examples cited were from cases of silicosis modified by iron. Not so many inoculation tests had been made with silicosis of other types, but there had been a few and the sections in all of the cases had likewise revealed very few tubercle bacilli."

I certainly cannot agree with Gardner in his conclusions. The absence of the development of tuberculous disease in the guinea pigs is convincing evidence that the four sidero-silicotics did not die of clinical pulmonary tuberculosis. Gardner[24] states: "Silicosis is the menace that it is because it specifically predisposes to tuberculosis. It is the latter which is responsible for disability, lost time, and in many cases death, and it is really tuberculosis against which we have to fight." I certainly challenge that statement. What specific proof has Gardner presented which allows such a statement? Let us discuss the various facts on which tuberculosis and silicosis have been linked so closely.

THE HIGH MORTALITY OF TUBERCULOSIS IN SILICOSIS: The high mortality rate is computed from vital statistics. Here occurs the greatest source for error because the death certificates have been based on x-ray or clinical experience of the local physician who tabulates every silicotic death as pulmonary tuberculosis. There are few studies based on cases carefully examined, and x-rayed, and who have had sputum examination. The absence of tubercle bacilli in the sputum of a patient dying of anoxemia in advanced silicosis is completely ignored and the cause of death is attributed to silico-tuberculosis. Such statistics are of no value. Based on such statistics, Jarvis[25] reported a death rate of 85% tuberculous deaths among silicotic workers in Washington County, Vermont, over a period of 20 years prior to 1921. McFarland,[26] quoting Hoffman's figures of 1095.5 deaths per 100,000 in silicotics compared to 94.6 per 100,000 in males over the age of 20, pointed out the frequency of tuberculosis in granite workers. Hoffman's study was based on vital statistics.

The experience of Ornstein and Ulmar[27] on 96 cases of silicosis sent to the Metropolitan and Sea View Hospitals demonstrates the confusion of labelling advanced silicosis as tuberculosis. All the silicotics were sent in with the diagnosis of pulmonary tuberculosis, and silicosis was only suspected by the senders in 19 of the 96 cases. Twenty-eight cases had no pulmonary tuberculosis. All sputum examinations were negative for tubercle bacilli. If a group of advanced silicotics can be referred by various pulmonary out-patient departments to an institution without suspecting silicosis, it is not difficult to understand why in the silica-exposed areas the local doctor calls all silicotic deaths pulmonary tuberculosis or silico- tuberculosis. Because of these conclusions from vital statistics, we have been given the impression of the high death rate in silicosis caused by tuberculosis. Gardner, Lanza, and Riddle still continue to talk of high tuberculosis death rates in silicosis. Yet when we examine the autopsy report of Boehme[29] of 126 stone cutters, the death rate, although high (19.3%) is not as high as Gardner[30] suggests it is (65%).

Boehme's report is quoted below:

83 had silicosis;

16 (or 19.3%) of the above 83 had pulmonary tuberculosis;

43 were free of silicosis and, of the 43, two had pulmonary tuberculosis.

Gardner bases his 65% on autopsy material collected from all over the country. Whether this material came from the tuberculosis sanitarium, which would naturally give a high incidence of tuberculosis, was not stated. At Sea View Hospital, out of 41 autopsies, there were six cases that died of advanced silicosis and had no tuberculosis. One case was discharged from the hospital as ad-

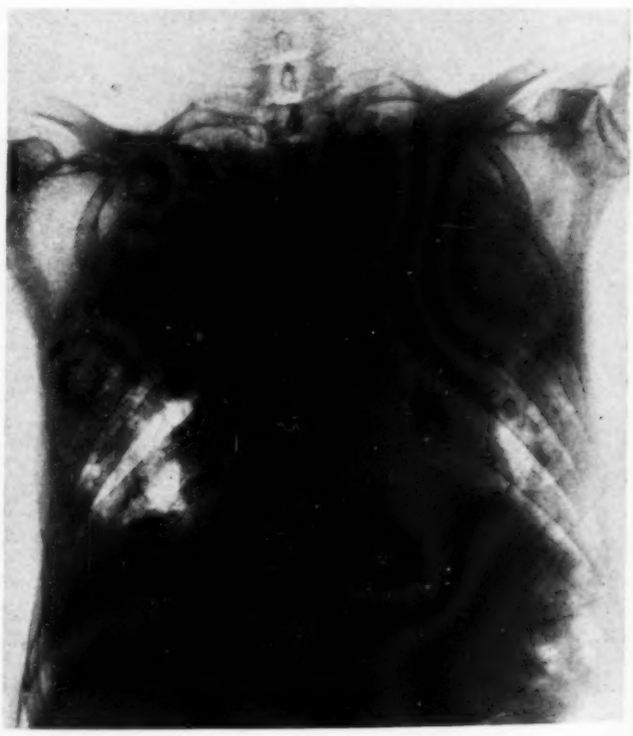

FIG. 1.

CASE I. An x-ray of far advanced silicosis diagnosed as pulmonary tuberculosis and sent to Sea View Hospital as an advanced case of pulmonary tuberculosis. The sputum was repeatedly negative for tubercle bacilli. The patient was discharged as an advanced case of silicosis with no pulmonary tuberculosis. After being out of the hospital for a few months, he again returned with a diagnosis of pulmonary tuberculosis. During this admission he died of heart failure and acute anoxemia. The autopsy (Fig. 2) revealed no evidence of pulmonary tuberculosis. He had an advanced silicosis with degenerative changes and even the formation of cavities

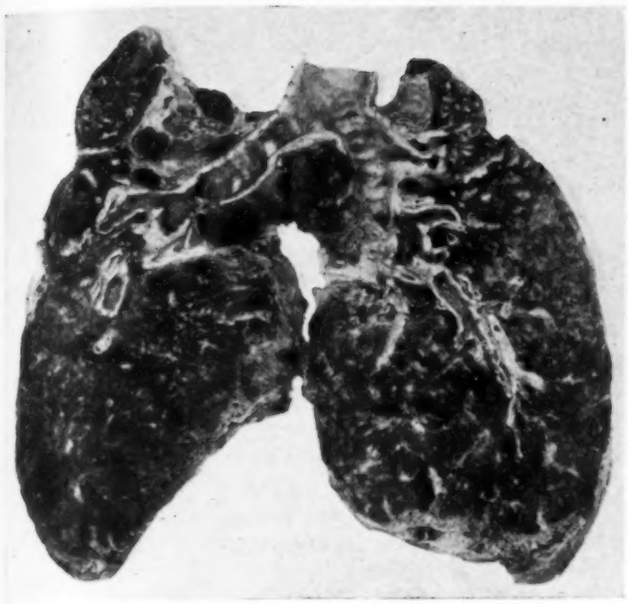

FIG. 2.

CASE I. This shows a section of the lung. Patient admitted to Sea View Hospital as an advanced case of pulmonary tuberculosis. The autopsy revealed an advanced silicosis in both lungs, and in the left lung there were mutiple cavities due to degenerative changes of the silicotic tissues

vanced silicosis, but after a short period returned as an advanced tuberculosis. On the last admission, he died, and the autopsy revealed an advanced silicosis and no tuberculosis.

(Fig. 1 is the x-ray, and Fig. 2 is a section of the silicotic lung.)

There is one other pertinent thing to be discussed. Suppose tubercle structure is found at autopsy in an advanced silicosis, shall the death certificate be signed silico-tuberculosis or pulmonary tuberculosis? When the diagnosis of pulmonary tuberculosis is made at autopsy as the cause of death, there should be sufficient evidence of tuberculosis disease to account for the death of the patient.

The Susceptibility of the Silicotic Lung to Tuberculous Infection: Most investigators express the opinion that silicosis produces a susceptibility of the lung tissues to tuberculosis. Whereas among clinicians there has been a small minority (Aldridge,[32] Tatham,[33] Committee of the Transvaal Medical Society,[34] Hayhurst, Kindel, Neiswander and Barrett,[48] Ornstein and Ulmar[27]) challenging the opinion, the preponderance of the investigators leans towards the theory of definite susceptibility. The experimental work is based on experiments of Gardner with R I tubercle bacilli, which is supposedly a low virulent tubercle bacilli. Gardner has demonstrated the influence of silica on the stimulation of the R I tubercle bacilli by the silica particles.

Among humans the susceptibility varies. Tuberculous infection occurs many years after the deposit of the silica in the lungs. A silicotic may not develop his tuberculosis until late in life, in spite of having silicosis for 20 to 30 years previously. Yet in the guinea pig, there is evidence of susceptibility to silica dust from the start to the finish. There can only be one explanation for the late involvement of tuberculosis in the human, and that is the avoidance of exogenous infection. This we must doubt because they belong to the group in which the incidence of tuberculous disease is high. Their economic strata and the supposed high incidence of tuberculosis among silicosis suggest frequent opportunities for infection. Yet this group develops tuberculosis late in life. It is common to find tuberculosis in an upper lobe and, though both lungs have extensive silicosis, the disease does not spread in spite of the high Gaffky positive sputum for tubercle bacilli.

How can we discuss the marked susceptibility of silicotic lung tissue to tuberculosis in one breath and in the other talk of a slow progressive disease with so little growth of tubercle bacilli that they are difficult to demonstrate in the sputum. At the same time, the beneficial effect of silica in artificial media for the growth of tubercle bacilli is discussed (Vorwald, Dworski, and Steenken[31]). Tubercle bacilli begin to grow quite rapidly in the tissues that are reacting vigorously to infected or inhaled silica. When the silicotic lesions are mature and active inflammatory responses have subsided, the stimulating effects are not so obvious; in fact, it even appears that the bacilli barely remain alive in old silicotic fibrosis.

There is no definite proof of susceptibility in the humans except the conclusions based on the high mortality of tuberculosis in silicosis made from vital statistics. This is a weak basis for such definite opinions.

The Low Degree of Infectiousness Shown by the Silico-Tuberculosis Patient: Cobbett[35] pointed out that in grinders and ganister workers of Sheffield, the stone cutters of Grinshill and elsewhere, the flint knappers of Brandon and the tin miners of Cornwall, there is not a correspondingly high death rate from tuberculosis among their womenfolk and children.

Wheatley[36] reports that in the parishes of Clive and Grinshill, of Shropshire, where there are quarries, half the stone workers die of tuberculosis, and yet there is no excess of tuberculosis among the women and young folks in the parish.

Collis[37] also speaks of "the immunity from phthisis of the wives and widows of the flint knappers;" McFarland[3] also points out the infrequency of cross-infection in the families of the granite workers in Vermont and tries to explain it on the basis of infrequency of finding tubercle bacilli in silico-tuberculosis cases.

Let us analyze the situation. Here are patients with manifest tuberculous disease both by physical findings and x-ray examination and we are told that when silicosis occurs, tubercle bacilli may be scant or absent. Would we accept any other fibrotic disease of the lungs with absence of tubercle bacilli and label the disease as tuberculosis? Can we accept such statements without proof? Is it not contrary to our clinical experience that progressive tuberculosis may go on rapidly with nega-

tive sputum? The answer is simple. These workers have silicosis but no active clinical pulmonary tuberculosis.

The author wishes to emphasize the following:

1. There are dangers of error in differentiation between silicosis and pulmonary tuberculosis.
2. The very high frequency and death rate of tuberculosis as a complication of silicosis are challenged.
3. The susceptibility of the silicotic to tuberculosis is debatable.
4. The low degree of infectiousness in the silicotuberculosis patient is more legend than truth.
5. Clinical tuberculosis should not be diagnosed in silicosis unless tubercle bacilli are demonstrable in repeated sputum examinations.
6. The whole question of the close relationship of silicosis and tuberculosis should again be brought up for re-consideration. A more careful analysis of the material should be done than has been in the past.

Trauma and Tuberculosis

FROM the time of the establishment of compensation laws, the problem of the relationship of trauma to tuberculosis has been an important medicolegal topic. The subject is important from the standpoint of both the employee and employer. Both groups have suffered unjustly because of the confused concepts of the effects of trauma on tuberculosis. Except under the most unusual circumstances where with trauma there may be an implantation of tubercle bacilli in the body, the relationship of trauma to tuberculosis must always by an indirect one. Tuberculosis has a specific etiology, the tubercle bacillus and therefore trauma cannot produce the disease. Trauma can, however, reactivate a previous existing dormant tuberculosis or cause rapid progression in a previous existing active tuberculosis. Most of the confusion comes from the varied opinions concerning the time interval which may elapse from the date of the injury to recognition of the tuberculous disease.

Mayer,[38] Lewy,[39] and Krause[40] believe that the time element is not important. Mayer states: "Inasmuch as tuberculosis is a slowly developing disease, it is not feasible to set a time limit. To postulate a definite time limit in days or weeks is an error, as it may take months for a tuberculosis to become manifest." Lewy believes the time limit should not exceed six months. Krause states: "Any attempt to lay down fixed intervals is purely gratuitous." On the other hand, Ornstein and Ulmar[41] again brought attention to the fact that in humans previously infected by tubercle bacilli, there is manifest evidence of re-infection in 24 to 48 hours (Koch phenomenon). Inasmuch as trauma releases tubercle bacilli from a quiescent focus, an immediate reaction (Koch phenomenon) must take place in new tissues in which the tubercle bacilli are implanted. In the lungs these reactions can be visualized by x-ray examination. All traumatic injuries should be x-rayed immediately and at the end of the first or second week. If there have been no changes noted in this interval of time, it is logical to assume that the trauma has no causal connection with the tuberculous disease which may develop at a later date. Unfortunately no x-rays are taken routinely the day of the injury and again within a week or two. Should pulmonary tuberculosis manifest itself six months later it is difficult to formulate a definite opinion as to causal connections. The quiescent disease of itself may go on to progression without trauma. An x-ray taken the day of the accident and again within two weeks would rule out all unjust claims. Without such x-ray evidence, the question of causal connection is an open one. In those cases where there is a train of symptoms from the time of the trauma, there should be no confusion. However, it is common for people to work continuously without suspecting their pulmonary tuberculosis, even when they are in the advanced stages of the disease.

More than 80% of the cases when diagnosed pulmonary tuberculosis are in the advanced stages and have worked until, or close to, the day of the diagnosis. Then why should we look upon the fact that the injured were able to work after the trauma as evidence that the injury had no causal connection with the activation of the tuberculosis disease? Such reasoning is wrong. When the traumatized workers continue their gainful occupation and at the same time show evidence of fatigue, loss of weight, cough, expectoration and other symptoms upon which the diagnosis of the tuberculosis is made, the fact that they carried on should not be used as evidence of no causal connection with their injury. On the other hand, if in this time interval between the injury and the manifestation of the disease there was no evidence of symptoms and the worker enjoyed good health even for a short period of time following the injury this is sufficient evidence of no causal connection. Again the simplest means of definitely solving the causal connection between trauma and tuberculosis are the immediate and later (one to two weeks) x-rays of the lungs after any injury to the thorax.

Inasmuch as the employer's responsibility ends when the employees are returned to their *status quo ante*, the x-ray of the day of the injury is the most important factor. If I have not made myself clear, the x-ray taken within a few hours after the trauma can be used as evidence of the *status quo ante*, should tuberculosis develop. Manifest evidence of the tuberculosis begins from the eighth hour after the implantation of the tubercle bacilli in the sensitized tissue and reaches the maximum reaction in 24 to 48 hours. When the patients are back to their *status quo ante*, the employer's responsibility ends. Inasmuch as an x-ray on the day of injury is seldom taken, the *status quo ante* usually means an arrest of the pulmonary tuberculosis. Pulmonary tuberculosis frequently is complicated by chronic emphysema which may sufficiently decrease pulmonary ventilation to cause a chronic anoxemia. Such a complication may occur in arrested pulmonary tuberculosis.

The total disability now is due to the complicating emphysema and not to the tuberculosis.

Measuring Pulmonary Disability

THERE is a simple way of measuring pulmonary disability. Based on the work of Sturgis, Peabody, *et al.*[42] and Kaltreider and McCann[43] the author[44] has worked out a simple formula which will give the figure equal to the number of times the maximum minute ventilation is greater than resting minute ventilation. Normally the figure is 10.

$$\frac{\text{Actual Vital Capacity } x\ 10}{\text{Calculated normal vital capacity}} =$$

For example, if the actual vital capacity measured through a spirometer was 3,000 and the calculated normal vital capacity for height and weight and sex was 3,000, the pulmonary reserve ventilation would be

$$\frac{3000\ x\ 10}{3000} = 10$$

Sturgis and Peabody *et al.* noted that one could carry on the normal routine of life with practically no signs of dyspnea when the reserve ventilation was no less than six times the resting minute volume. Below this there was evidence of fatigue on effort. The author confirmed the work of the above group and also noted in chronic emphysema when the maximum pulmonary ventilation was below four times the resting minute ventilation, the prognosis was grave. This simple method of measuring disability may be used in all chronic pulmonary diseases.

Industrial Poisonings Capable of Activating Pulmonary Tuberculosis

OBNOXIOUS gases and vapors may also activate a pre-existent pulmonary tuberculosis. The activation is produced by the inflammatory process caused in the vicinity of the pre-existing tuberculous disease of the lung by the irritant chemicals:

Ammonia — A sudden escape of ammonia in either gaseous or liquid form.

Benzine poisoning.

Effects of brass fumes.

Chlorine gas—hydrochloric acid.

Hydrogen sulphid.

Nitric acid fumes.

Phosgene—in dye industry.

Sulphur dioxide—sulphuric acid.

Selenium—in the melting of selenium.

Nickel carboxyl.

Vanadium poisoning—vanadium is used in the steel industry to make ductile steel. Peruvian ores are rich in vanadium.

These are a few of the industrial poisons capable of irritating severely the broncho-pulmonary system (Hamilton[45]) and activating a pre-existing pulmonary tuberculosis. The time interval would be the same as in trauma and tuberculosis.

Extra-Pulmonary Tuberculosis

IN extra-pulmonary tuberculosis trauma also plays an important role. Here we deal with various forms of tuberculosis such as kidney, prostate, epididymis, seminal vesicle, bladder, bone, gland, tuberculoma of the brain, etc. In this group the time element is not so definite; not that there is no immediate reaction to the reinfection by the tubercle bacilli as in the lung, but because of our inability to demonstrate the immediate spread of tuberculosis. We know that a kidney tuberculosis may be progressive and unsuspected. The situation is similar in bone tuberculosis, where the x-rays demonstrate evidence of tuberculosis only in the end-stage of the disease. This is especially true in tuberculosis of the spine. Ornstein and Ulmar[46] have demonstrated that even after removal of the diseased spine from the cadaver, the x-rays may be misleading as to the vertebral disease. In other words, in some forms of tuberculosis, progression of disease may occur without symptoms or demonstrable x-ray evidence of the tuberculous infection. This is especially true in bone tuberculosis. Therefore, following trauma there may be an activation of a tuberculous process without any immediate clinical evidence of the occurrence of the activation, and months later the wrist, ankle or spine may begin to show evidence of the tuberculous disease. There may be a lapse of even a year or more before enough destruction occurs to enable one to visualize the disease by x-ray.

In extra-pulmonary tuberculosis, logical reasoning is further upset by the frequency of hematogenous spreads of tuberculosis. In many cases the first complaint or suspicion of the disease is after a hematogenous infection of the lungs. A physician familiar with hematogenous spreads, looking for an extra-pulmonary focus, finds tuberculous caries of the right metacarpal bones. The patient has had some pain and tenderness and remembers that, eight months previously, he had a fall on the right hand. An x-ray now demonstrates a tuberculous disease of the metacarpal bones. The lungs are much involved, with a hematogenous tuberculous infection. A long time has elapsed between the trauma and the manifestation of the

In view of a clear and proved history of trauma to an extrapulmonary focus of tuberculous infection, the probability of the causal connection of the clinical tuberculous disease is in favor of the worker, even if the hematogenous infection of the lungs, the miliary tuberculosis, the tuberculous meningitis occurs months and even one or two years after the trauma. Unfortunately, some clinicians, to the detriment of the worker, attempt to attribute the extrapulmonary tuberculous focus to the disease in the lungs. Some are willing to accept the responsibility of the extra-pulmonary disease because of an injury to a hand, foot, etc. They will not accept the cause of death (hematogenous infection) as having any causal relationship except a contributory one. The author admits that such a situation is possible but not probable. Autopsies have demonstrated the infrequency of

hematogenous infections from caseous pneumonic tuberculosis. All investigators are agreed that almost all forms of hematogenous infections are associated with extra-pulmonary tuberculosis. Reisner[47] has made an excellent contribution to the knowledge of hematogenous infections in which he pointed out the frequency of kidney, bone tuberculosis, etc., as the chief sources of hematogenous dissemination of the disease.

Therefore, in extra-pulmonary tuberculosis the time element plays an insignificant role in the causal relationship of tuberculosis and trauma. There are a few exceptions, as in tuberculosis of the epididymes and seminal vesicles. Manifest evidence of the reactivation should be present following injury to these organs. In a similar manner, when superficial lymph glands are the source of the reactivation, there should be immediate evidence of the reaction.

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Discussion:

DR. BENJAMIN GOLDBERG (Chicago): Dr. Ornstein's statements, as you may know by this time, are somewhat at variance with the reports that have been published in the literature in the past several years as they deal with both tuberculosis in industry and silicotuberculosis. It happens, however, that I am in full accord with his ideas in this matter and we have been interested in pursuing investigative effort in this field somewhat relatedly.

Tuberculosis, you must remember, involves a two-fold consideration: In the first place, infection with tubercle bacilli and, in the second place, the result of such infection in the human body or reactivity of the tissue or sensitization of the tissue coming from such infection.

These two factors must be present before tuberculosis can occur in tissue.

How is this affected by industry? Well, we know that infection is the result of contact with individuals who have the disease or who have disseminated certain secreta from disease processes so that they came in contact with other individuals. Such infection very frequently has to occur repeatedly, the organisms have to be present in number, and they have to be virulent.

Housing is rather important. Congestion which allows of intimate contact is more important, and such intimate contact occurs not only in life outside of industry but also in industry itself. Some 28 years ago, when I started my work in tuberculosis, the big battles were on with the sweat-shops, the tobacco industry, and the like, and very little heed was paid to the fact that these individuals sat one upon another in congested quarters with inadequate ventilation and were able to spread, by the means of such close contact, infection that was rather intense in its numbers and recurred rather frequently, so that the incidence of disease and mortality was very high.

As to the reactivity of tissue, this varies in different individuals, based on the biochemical response of the individual, particularly to habits in living—such things as induced fatigue; fear; diet; the habits that are racial as they affect the living conditions of various peoples. And these variations of reactivity are the factors that allow the production of serious cases by disease which is rapid in its spread, and has a high mortality, and disease with a low mortality, of the type that is benign or has a tendency

to cause fixed tissue, cell proliferations, or become fibroid or non-liquefying, which does not spread very rapidly.

In industry we sometimes find a lack of protection because of congestion that may occur, but in no industry do we feel that tuberculosis is due to the industry *per se*. Dr. Ornstein stated that rather ably. The industry does not cause the disease, but it may be a contributing factor through congestion and through inadequate housing of employees.

What can industry do to prevent this?

In the first place, it can select individuals for employment among whom there is no wide dissemination of tubercular infection.

That requires examination of all employees, not only physically but also on a roentgen basis to make sure no manifest disease is present.

Secondly, industry should re-examine individuals who report with respiratory infection and make certain it is not tuberculous in nature.

And thirdly, industry can provide adequate housing within its own walls to make certain that dissemination of infection does not occur among its employees within the confines of their employment.

I am not entering into a discussion as to wages, or the economics of labor. It is self evident that individuals who do not have an adequate income can not live adequately. We can trace back the high mortality rates among certain racial groups and among certain groups in our population in every instance to housing or some factor associated with housing.

So far as silicosis is concerned, I agree with Dr. Ornstein, and my agreement with him is based on some pathological studies that we made and discussed with the late Richard Jaffe at Cook County Hospital in this city. We noted in studying individuals with silicosis that those with the productive type of silicosis, having the marked increase in fixed tissue cells, were usually not tubercular. Indeed, they were very rarely tubercular.

In individuals with the nodular type of silicosis there was presented the typical clinical picture, the picture on physical examination, and the picture on roentgen examination, of the average individual with tuberculosis. There was a tendency for liquefaction to occur in the nodules, for cavitation to follow such liquefaction, and for the cavities to become larger due to coalescence.

Only in instances where a dormant tuberculosis was present, in which dormant lesion there were viable tubercle bacilli which became included in the liquefying process as far as the lungs were concerned so the tubercle bacilli were liberated in the liquefying silicosis and exuded in the bronchial tract and into the outer world to be found in such sputum, was there tuberculosis.

Exogenous re-infection is a possibility, but not a very common one, in such individuals. And I have to agree with Dr. Ornstein in his feeling on silicosis because of these observations.

I feel that Dr. Ornstein should be complimented on his courage in coming here and giving us these definite facts which practical experience in human beings and not animals has yielded.

DR. EMERY R. HAYHURST (Columbus): I have listened to Dr. Ornstein's paper with very great interest.

Let me say that in 1925, Sleeswijk (a Dutchman) reported at the Fourth International Congress on Industrial Diseases, 863 sandstone workers carefully examined with x-rays, where there was a high degree of silicosis and only six cases of tuberculosis.

In 1926 I investigated, with a staff in Ohio, 920 sandstone workers, of whom we got good x-rays—stereoscopic films—on 912. We found 12 of those in whom we thought there might be tuberculosis. There were five other cases of frank tuberculosis without silicosis.

In all my industrial investigation since then I have been more than convinced of the absence of tuberculosis in silicotic cases, until I came to the conclusion some years since, and published the same, that obviously the earlier English writers of about 20 years ago—I believe Middleton, Purdry, and one or two others—were right.

The two diseases are quite antagonistic. Silicosis is a fibrosis producing disease. Tuberculosis, of course, is a destructive disease. I have recently translated in INDUSTRIAL MEDICINE* two articles from Conrozier and Magnin, stating their experience in southeastern France in the Gard basin, and it is their belief also that they have a peculiar condition in which tuberculosis is very rare among their miners, but when they get into stone they develop and go on to death even with pure cases of silicosis and with almost no evidence of tuberculosis.

Dr. Spector, of St. Louis, reported in the *Southern Medical Journal*, last October or November, five autopsies bearing out exactly what Dr. Ornstein has shown here. Some of these men had extreme cavities which were all autopsied and found to be negative for tuberculosis.

I would call attention to the article by Dr. Gardner. I am sorry he is not here to speak for himself. This was published in the *Archives of Pathology*, I think, last December. He states that microscopically every pathological finding of the two diseases may be alike; that you can not find one type of microscopical finding in the lungs in silicosis that you can not find in tuberculosis, and vice versa.

DR. NORBERT ENZER (Milwaukee): I think that to congratulate Dr. Ornstein for his presentation is mild, because it takes courage to present arguments of his type. However, I am not in entire agreement with Dr. Ornstein, nor with Dr. Goldberg.

I believe that one very fundamental thing must be established. Upon what criteria is the diagnosis of tuberculosis to be made? I always like to use the analogy of syphilis. I don't have to find the spirochete to diagnose the syphilitic aorta; and there are many forms of tuberculosis in which the tubercle bacillus can not be demonstrated.

I have autopsied some 133 individuals who have had some degree of silicosis, and I have never failed to find in a single one of those 133 instances the influence of a pre-existing tuberculosis lesion on the silicotic pattern.

And to me, one of the most impressive things about the human material in contrast with the animal material —for I quite agree with Dr. Goldberg that animal experience can not be entirely translated into human experience—is that the combination of tubercular granulation tissue and silicotic fibrosis constitutes a new and independent entity. And to me, the very striking thing is that silicotic fibrosis has a curious choice of selection in the lung tissue. It has a very bad habit, even in very minimum amounts, of associating itself with the pre-existent tubercular focus.

DR. ORNSTEIN: Concerning the comments of Dr. Hayhurst, it is a pleasant surprise to me to find that he, for so many years before me, had such opinions.

Dr. Enzer brought up the question of the diagnosis of tuberculosis and silicosis. Our problem is not a diagnosis of tuberculosis and silicosis but a question of autopsy diagnosis, and I stand on my opinion that when you have an autopsy death and you are willing to mark it pulmonary tuberculosis, except in rare circumstances, you always have tubercle bacilli. In those cases in which you do not have tubercle bacilli, you might have miliary tuberculosis, rarely a productive tuberculosis.

But when you see these deaths as we have seen them at Seaview, in those 35 cases that died of tuberculosis, there were so many tubercle bacilli you have no trouble at all demonstrating them, and there was enough destructive disease.

It isn't my purpose to make this discussion of mine a definite one. My only hope was to stimulate enough interest to re-open the whole subject, and if we are wrong we will acknowledge it, but those who now disagree, if they are wrong, they, too, must acknowledge it.

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* See: "Tumor-Like Images in Silicosis," *Industrial Medicine*, April, 1938, p. 179; and "Sixty Radiographs of Silicosis," *Industrial Medicine*, May, 1938, p. 239.

Employability of Persons Presenting Disability and Disease

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THE subject on which I will attempt to present a few of my personal ideas and opinions is one which should arouse the interest of every person who has to deal with employees as well as of every person interested in any phase of social work. It is one which requires a rather fine line of discrimination in the duties and the responsibilities of management; to employees on the one hand and to stockholders on the other.

Management has a very fine line to draw and a difficult decision to make in the handling of physically handicapped persons. On the one hand is the moral and social obligation to employees and to applicant for work to try to rehabilitate them and to establish them as self-respecting, self-supporting members of society.

On the other hand there is the very definite obligation to the owners of a business to see to it that they are not exposed to unnecessary risks which may involve heavy financial losses.

This is especially true since the ownership of industry has become so widespread that many widows and aged people of small means are now the owners of business and dependent in a large degree on the earnings of business.

It is unfortunate indeed that many of our state laws and many of the interpretations of them are resulting in the creation of a class of unemployable persons. A large group of people who would gladly work are being denied that opportunity because of the burdens that are now imposed upon employers through unwise and unfair laws covering disabilities and diseases.

I wish I had the answer to this problem, but I do not pretend to have. I only intend to present some of the difficulties which are encountered, and make a few suggestions which I hope may be helpful.

The effect upon the morale of the person who cannot find employment because of a physical limitation is horrible, and such a condition produces a state of desperation which could easily result in appalling consequences.

I have in mind a recent occurrence in one of our plants which illustrates this point. A young man, 22 years old, in splendid physical condition, had worked for us for a number of months when one day he was stricken with a seizure which turned out to be an epileptic fit. In our effort to treat the case with the utmost of sympathy we permitted him to return to his work, hoping that the seizure might not be repeated. At the same time we realized that it was a most hazardous thing to do both for ourselves and for him.

The man was employed as a millwright and had to handle heavy pieces of machinery. He had to climb on ladders and scaffolds around moving shafts and pulleys. A second seizure occurred within a few weeks. Fortunately he was not injured as a result of this seizure, but we decided that we could no longer employ him at his trade—that we would try to find him some sort of work where he would not be exposed to such unusual hazards as those of a millwright. When he was advised of this fact the poor fellow completely lost control of himself and viciously assaulted the physician who was talking with him. It might have been a very serious matter but for the intervention of other persons. I am sure the physician understood the man's mental state because he immediately condoned the assault.

The point is, *that* boy is out of a job today and no employer can safely run the risk of giving him employment—it being neither safe for the man himself nor for the employer to have him around in the average industrial establishment.

I have to say very frankly that I have no answer or suggestion for such a case, but if socially minded persons could devise a way that the employer would be absolved from the risk involved, a person so afflicted would at least have the opportunity of earning a living even though he might jeopardize his own safety by accepting such employment.

PHYSICALLY handicapped persons fall into different groups:

1. There are those employees who have some sort of permanent disability which has resulted from an industrial accident.

2. Also those employees who have or are susceptible to an occupational disease, the nature of which precludes their re-employment in their former work or at their regular trade.

3. Then there are persons who have sustained some permanent disability as a result of a non-industrial accident.

4. Also persons who have some form of sickness or disease which has no relation whatever to their occupations.

As to the first two classes I believe that industry as a whole has made a sincere effort to find suitable employment for workmen who incur disabilities as a result of an industrial accident in their own plant or as a result of a typical occupational disease. The actual placement of this sort of person has been a problem that has had to be worked out by the employment manager in close cooperation with the plant physician.

This is not always an easy problem. The greatest care must be used not to incur any unusual hazard of further injury, and the finding of suitable work for such a handicapped workman presents great difficulties. A chauffeur who has lost an eye is hardly competent to remain at that class of work, and it is obvious that he must be placed at a job where the chance of injuring his remaining eye is remote.

Since the physician and the employment manager are best qualified to determine the working ability of the man, they must accept the responsibility for selecting his new job. The medical treatment in its broad sense does not terminate with the employee's recovery or with his placement on the new job. The job is a very definite part of the medical service to the employee. Rehabilitation is not complete until the disabled employee has become self-reliant and self-supporting. Two things are necessary to accomplish this—the first is a job, and the second is determination to overcome any mental deterioration due to a shocking injury. The employer holds the key to the former, and the physician by appropriate treatment must do everything possible to overcome the latter. The task is not an easy one, but failure in either respect all too frequently results in that "medicolegal" diagnosis of that very intangible, but at the same time, very real trouble, "neurosis." In the simulated cases, cash settlements have frequently produced remarkable results, but I have never known them to accomplish rehabilitation in the slightest degree. In genuine cases the loss to the individual, his family, the community, and to the employer is appalling.

In determining the employability of a handicapped person it is obvious that the employer will be careful to ascertain whether or not the employment exposes him to any special hazard. The compensation laws of many states have established certain injuries as constituting permanent and complete disability; for example, the loss of the hands or eyes, or the loss of any two members of the group mentioned. Consequently, if an employer accepted a workman having a disability consisting of the loss of an eye or arm, and the workman sustained the loss of the other member, the employer is called upon to pay compensation, not for the loss of the member thus destroyed while in his service, but for the complete and total disability. Unless laws of that nature are amended it will be virtually impossible for disabled workmen to obtain employment.

The Legislature of Illinois quickly recognized the situation thus created and amended the statute whereby the employer must pay the scheduled loss for a permanent injury, and thereafter further compensation would be paid to the workman out of a special fund, so that the sum total is equal to the scheduled loss for total disability. This legislation in Illinois has been very helpful. It has opened the door of employment for men handicapped as a result of injury; it has imposed upon the immediate employer no greater loss in the event of subsequent injury, where the combination of both injuries constitutes total disability. At the same time it has protected the injured employee by providing compensation over and above that which the immediate employer pays. The fund for the payment of this compensation is accumulated by imposing a special charge in a certain type of cases and the burden falls on industry as a whole and not too heavily on any individual employer.

There has been an approach to this problem in many of the other states and, consequently, I believe it has been generally recognized as sound public policy. Unfortunately, it is not uniform throughout the states, but we shall consider that later.

I believe that employers generally are attempting in every way possible to prevent occupational diseases. It is becoming more and more necessary that they do so, and I further feel that where employees have true, bona fide, and readily identifiable diseases which are occupational in their nature, employers are doing everything they can to adapt such afflicted employees either to new lines of work or to take steps to prevent recurrences.

THE whole occupational disease problem and hazard is one that ties in very closely with the plant physician. He should be the one to recognize the hazard and to bring to the attention of the management the means of minimizing it.

This includes the discovery of unhealthful conditions and the elimination of unnecessary hazards; the selection of workmen who are the most physically fit to withstand unavoidable hazards; the alternating of jobs among individuals so as to limit the exposure to any hazard; and, wherever possible, the re-examination of the working force periodically. This method has been applied to the painters in our organization over the period of the past 20 years. In this case re-examinations are required by law, and we have made them at the definite intervals of a month by the same physician. The work has been rotated and alternated, and we are proud of the fact that during this time we have not had a single case of lead poisoning.

Naturally, the physicians have done a great deal of educational work in teaching these men how to care for themselves and in explaining to them the reasons for the periodic examinations, as well as the desirability of alternating the jobs.

The physician has also assisted the foremen in giving instructions to the employees as to the manner in which their work might be done with a minimum of exposure.

We have extended the alternating job plan to employees exposed to dust hazards and their attendant respiratory diseases. The physician who is a part of this program must, of necessity, be thoroughly familiar with operations in the plant.

Being fully aware of the occupational disease hazards in a given industry the examining physician is confronted with a difficult and unenviable task of breaking the news when his examination reveals that a prospective employee is not fit to work at a particular job. This is not good news to the applicant and it is not a pleasant duty for the physician to have to tell him so. At the same time, it is necessary both from the standpoint of the physician's duty toward the applicant and toward the employer.

THE question of periodical physical examinations is a highly controversial one and it has been opposed by labor organizations for many years. Their opposition to it is based on the fact

that the employee may lose his job as the result of the discovery of some physical defect. The medical profession has done a pretty good job in teaching the public generally of the value of periodic examinations, and I feel that they should continue to promote this very worthwhile activity. They must at the same time have the active cooperation of the employer if periodical examinations are to be accepted and made of real value. The employer can cooperate by helping the employee and the physician to work out corrective procedures and not simply discharge the employee because of the discovery of a physical disability.

We know that there is a need for periodic examinations. This need is shown clearly by the findings of physicians engaged in the examining of applicants seeking work. There is no doubt but that the conditions commonly discovered in applicants would run through the ranks of the regularly employed people.

There is a great field for improvement in bringing about the practice and the acceptance of periodical re-examinations. To my way of thinking the industrial physician is the most articulate force in educating the public to this need, although there are many other agencies contributing to this job. It is a real service to the individual, to his family, and to our national economy in stopping the encroachment of disease. Our national welfare is only the sum total of the well being of the individuals comprising the group. Accordingly, if we have a class of individuals who cannot earn a livelihood by reason of physical limitations and because employers are being charged with disabilities not directly due to occupational injury or disease, then manifestly our national welfare is impaired.

I BELIEVE industry is being called upon to pay compensation for diseases having no relation to the occupation; in fact, many workers presently employed have acquired lesions in no wise related to their work, which, if coupled with the will not to work, would afford them a pretty good opportunity to collect compensation. This would necessitate a claim of an occupational injury, plus corroborating medical testimony that the work in the industry reasonably and probably caused the disability.

As you know and I know, claims of this kind have been made and sustained. It is only natural that an employer called upon to respond in damages will seek the advice of the industrial physician as to the methods to be employed to avoid similar penalties. The physician honestly knowing that the occupation had nothing to do with the illness is, with respect to this particular claim, an advocate of the employer. It is also quite natural for the physician whose opinion was not accepted, to be quite chagrined, and with the employer and the physician having the same mental attitude toward the problem, their emotional judgment rather than their considered judgment, may lead them to adopting the policy of rejecting all applicants similarly afflicted. That may be a complete answer in a particular plant—for a limited time. It is no answer at all to the greater problem of finding employment for this class of workers.

As earlier pointed out, the Illinois Legislature found a method whereby employees suffering the loss or limitation of a major organ or member of the body could be re-employed and accepted on a par with their more fortunate co-workers. While admittedly the handicapped worker is generally limited to a particular field of employment there is plenty of evidence to show he can master almost any task reasonably adaptable to his physical handicap. He is an industrious and loyal worker, a good citizen, and a living example of medical skill. If it is a sound public policy to limit the liability of an employer who hires a workman known to be physically unsound in some respects, why shouldn't the employer be exempted if the man he hires is physically unsound in any respect? As the Illinois law now stands, the employer's liability is limited in the case of a workman who has only one arm or one leg, but if an injury aggravates or accelerates any physical disability which is not specifically exempted, the employer must pay compensation on the basis of the ultimate result rather than for the actual injury. It is the class of cases coming within the last mentioned rule that is responsible for the tendency on the part of employers to reject applicants whose physical condition indicates that the time is not far distant when inability to work shall either be partial or complete or alleged to be so. I have particularly in mind that class of employee who upon examination present some evidence of arthritis in its various forms or pulmonary or circulatory lesions of one type or another. We have had some experience with arthritis claims. About all that is necessary to substantiate a claim for disability is proof that an accident occurred; subjective complaints of pain (frequently of a fugitive nature); plus some evidence of spur formation, or other changes in the bony structures and the attachments thereto. Whether the complaints of pain are true or false, it is almost impossible to dispute the existence of pain because of the corroborative evidence which can be produced. It seems to be of no concern and certainly not much defense that the arthritis long antedated the injury; that there presently remained objective lesions that can be directly pointed to as the immediate cause of the disease, and that the cause, so long as it remains untreated, will prolong and intensify the disease, because the complaints of pain and discomfort are generally accepted as the factors which indicate that the disease was aggravated or accelerated by the so-called injury. Coronary thrombosis and cerebral hemorrhages, if occurring during working hours, offer excellent opportunities for claims for compensation. Pathologist's findings, however, often definitely show the cause of death or disability as distinctly the final result of changes in the structures over the course of many years. In some instances, the disease is so markedly advanced that the ultimate result was bound to occur. But the fact that it occurred at the place of work

rather than at home in bed, or on the street, is sufficient to make the employer respond and pay compensation, if there is any evidence to show any straining or exertion which might have precipitated the hemorrhage in the case of cerebral hemorrhages, or which might have dislodged the fatty plug in the case of the coronary disease.

The physician recognizes these conditions on his examination, but he cannot tell the employer that a man presenting that clinical picture will live a day or a decade. He can and does point out the danger in employing the man. That leaves the employer the choice of taking the risk, without any justification therefor, or avoiding the risk. The men charged with responsibility of managing business as it is constituted today are trustees. They are duty-bound to exercise such judgment as is best calculated to secure the well being of the employees operating the business and to conserve the money and property entrusted to their care by the owners. They cannot faithfully perform that duty and take the risk suggested. As a consequence, there is growing at a rapid pace this class of men and women who are unemployable.

Something must be done to relieve a situation which causes a development of that kind. Managing officers of a business concern do not want to reject applicants for employment by reason of illness and disability of the kind mentioned. We have found that such diseases and illness are generally manifest in men of middle age, who are skillful experienced workers and valuable employees. I think it can be safely said that the great majority of workmen so afflicted would willingly relinquish any claim they may ultimately have, by reason of any disability directly or indirectly traceable to the conditions existing upon their entering the employ, or to conditions which they acquire through the years of their employment, and which are wholly unrelated to their work, on condition, of course, that they be accepted for employment. The plain fact is they are interested in their well being for today and tomorrow, and unemployment is inconsistent with the well being of working people.

Getting jobs for these men is the problem. Industry does not want to bar them; the men are anxious to work and the medical profession will do whatever is possible to rehabilitate them. The Legislature has seen fit to adopt measures which afford employers an opportunity to employ men who suffered the loss of an arm, leg or eye; or who have sustained a pre-existing hernia; and the medical and engineering professions have done much to minimize true occupational diseases. Why, then, should not the class suffering disabilities acquired through sickness and disease unrelated to their employment be given the same opportunity to obtain work?

I CAN see no logic in the rule that denies compensation to a man who becomes disabled by the reason of the aggravation of a pre-existing hernia, where the same rule justifies an award for compensation by reason of an aggravated arthritis, and all the more so, when the evidence frequently shows that the aggravated hernia cannot be disputed, whereas the aggravated arthritis is violently disputed.

I mentioned before that legislation on this subject is not uniform. I think it should be, in order that the solution to the problem shall be national in scope. I do not advocate the adoption of a Federal law to accomplish it. A measure of that kind would be hotly contested by the proponents of state sovereignty, and by those who do not favor Federal legislation, in so far as such legislation affects labor. The problem is too important to raise any collateral issues, which would detract from it.

The National Conference of Commissioners on Uniform State Laws is a body deriving its authority from appointment by the Governors of their respective states. Up to the present time these Commissioners have drafted a number of uniform laws, as for example, the Sales Act, the Negotiable Instruments Acts, the Partnership Act, and in more recent years, the Act Regulating Traffic on Highways. These uniform laws have been adopted in a number of states. Some time ago the Commission prepared a uniform Workmen's Compensation Act and a uniform Occupational Disease Act, but apparently the various states have not seen fit to adopt the acts as drafted. It would seem to me that since we have come to a full realization that a vast group of workmen are denied an opportunity to obtain employment by reason of the inequities in the presently administered compensation laws, this Association of Industrial Physicians might well be the agency through which legislation could be promoted to meet this need.

The Workmen's Compensation statute in Illinois provides:

> "No employee, personal representative or beneficiary shall have power to waive any of the provisions of this Act in regard to the amount of compensation which may be payable to such employee, personal representative or beneficiary hereunder, except after approval by the Industrial Board."

I believe the necessary implication in this statute is that the Industrial Board does have authority to approve an agreement between an employee and an employer, which is fair and equitable, but the difficulty is that no standards have been fixed to guide the Industrial Commission. It would be exceedingly difficult for the Commission to approve an agreement between the employer and the employee, because there is no reasonable assurance that such an agreement would be valid or enforcible in the courts. Accordingly, therefore, if the suggestion with reference to uniform legislation is not practical because of the years of delay and the uncertainty of adoption in the various states, an effort could be made to amend the Illinois law and specifically authorize the Industrial Commission to approve agreements between employers and employees wherein the latter would waive the payment of compensation for disabilities subsequently resulting either directly or indirectly

from infirmities found and known to exist at the time the applicant presents himself for employment, or which he subsequently acquires. Proper safeguards, such as independent physical examinations by competent physicians, must, of course, be provided, so that no prejudical advantage be taken. In all cases the agreement waiving the Compensation Act should be accompanied with the report of the employer's medical examiner, as well as the report of the independent physician, so that the Industrial Commission could act in the best interest of all concerned.

Now, I feel that it is our plain duty not only as representatives of employers but also as citizens and as the brothers of that group of unfortunate people, the ranks of which are increasing every day, that we throw the spotlight on this condition and its causes, and that we stay with it until its correction is completed.

Discussion:

DR. JOHN LEEMING (Medical Counsel, Chicago Surface Lines): I think you will agree with me, after listening to this interesting and instructive discourse, that there are many able-bodied men who are willing to work and who have families to support, but who can't get employment because they have physical defects such as were mentioned by Mr. Ellerd, which physical defects are in themselves not noticeable.

What, exactly, are these physical defects? And why can't the men who have them get jobs? I will answer the last question first.

It is because we are compelled by law to operate under the Workmen's Compensation Act. It isn't optional as it was at first. It is compulsory, and if a man is given work who is possessed of certain physical defects which do not interfere with his ability to work, and he happens to get hurt in the course of his employment, the employer has to take the burden. He has to pay compensation. He has to pay the doctor's bills and all the hospital bills, which often cover many months and involve large amounts in money.

But, on the other hand, if the employer had rejected this applicant when he applied for work and had hired a man without any physical disability, the disability period for the same injury would have been only a few weeks, and the medical expense, of course, would be correspondingly less.

What are these physical defects? I need scarcely mention to you men who are engaged in our industrial work what they are. You are perfectly familiar with them. Take such conditions as varicose veins in the lower extremities; the different forms of hernia; high blood pressure and the underlying causes which produce it; defects of vision; tubercular disease; heart lesion; syphilis; arthritis; and many, many other conditions which you no doubt have in mind.

When a man who is afflicted with any of these conditions applies for work and is submitted for medical examination, his attention is called to his defect. He replies: "Why, I have had that for years. It never bothered me in the least." But let me ask you industrial surgeons: If you were an employer and a man asked for work and he had varicose veins which, according to his story, had never bothered him, and there were other applicants without this defect, would you hire the man with the varicose vein in his legs?

I have asked the question and I will answer it by saying that if you are experienced with the Industrial Board—if your experience has been anything like mine—you would not hire such a man.

I have a case right now under consideration where a man in the course of his employment was knocked down by a hit-and-run driver. He suffered an abrasion on the calf of his leg. He belittled the injury. He was off work only a day or two, but in a very short time he developed a typical varicose ulcer. Following this, he was unable to work for months. He was placed in a hospital with his leg elevated, and under such treatment, together with the use of suitable local applications, the ulcer finally healed. During this long period of medical and hospital treatment, the man was receiving compensation and his employer was paying all the hospital and all the medical bills.

So, I will ask you again: If you were an employer of labor, would you hire a man who had varicose veins in his leg even though he claimed they had never bothered him? I could ask you the same question with reference to dozens of other underlying physical defects which, in case of injury, would very materially lengthen the period of disability.

In a case of this general type, I once gave evidence before the Industrial Board that the prolonged disability was due to the underlying and pre-existing disease and that it was not really due to the injury; that the injury in question to a man in normal condition would not have disabled him for more than a week or two. The arbitrator said, after listening to my evidence: "When your company employed this man you either knew of his defect or, if you didn't know it, it was your business to have discovered it." Full award for compensation was given in that case. Since then, this same company has made it its business to discover such defects in advance, and, as a result, hundreds of men have been denied employment. And this is at a time when the city and the country need no help in adding to the number of men who are out of work.

In what I have said so far, I have referred mainly to the employment of new men. In the paper just read, the author has considered the different classes of workmen who suffer physical handicaps. He has fully covered the question of re-employment of such workers and the assistance given in rehabilitating them when they are laid off as a result of injury. Each of them has been temporarily off the job as a result of injury or disease, and he has pointed out the risks the employer takes if he puts a man back even though he claims to have fully recovered. This point was well illustrated by the difficulty presented in arthritic cases, and the same difficulty applies in many other troubles.

Compensation has been paid over long periods of time for slight injury to old chronic arthritic backs—backs which only a few days after the alleged injury revealed, on x-ray examination, calcium deposits with lipping and spur formation which it had taken months and years to develop.

Shall we recommend re-employment of such workmen as these, and have the employer assume the risk that goes with it? I say, not until the Workmen's Compensation Act has been amended as advised in the paper we have listened to tonight. No intelligent physician, certainly no industrial surgeon, can deny that an accident may rouse up a pre-existing latent condition, and the injury may localize certain constitutional disease, and in all these cases the period of disability is apt to be greatly prolonged.

These conditions make men more susceptible to injury and also lessen their recuperative power after injury, and yet the employer, under the Workmen's Compensation Act as it now stands, is liable for the results.

Cases of this sort show clearly the hazard, to the employer, of the pre-existing disease. It seems to me to be perfectly clear that unless the Act is amended, it will be very difficult, if not impossible, for men who have such defects to find employment.

As medical adviser to the employer, how can you advise him to assume the risk? What are you who are engaged in industrial surgery going to do about this situation? Are you going to take any action on the suggestion made by the speaker of the evening when he said that this Conference might well be the agency through which legislation could be adopted to meet this end?

My advice is that, until the Workmen's Compensation Act is amended along the lines suggested, the greatest

possible care should be used in taking on new men to employ men only who are physically and mentally sound. I recommend, further, that the medical men who are engaged to make these examinations should be industrial surgeons, medical men who realize that the employer takes the man as he is and not as he should be; medical men who realize that when old chronic conditions exist which in themselves are not disabling they may be aggravated by a mild injury and that the employer is then liable for the aggravation of these old chronic troubles, no matter how minor the injury may have been.

If you have had experience similar to mine, you will appreciate the termination, and, in my judgment, the climax, of Mr. Ellerd's paper, in which he points out that many applicants with physical defects are so anxious to return to work that they express a willingness to sign a waiver absolving the employer for liability from any claim for aggravation of a pre-existing condition. They are so anxious to go to work that they have said to me, repeatedly: "If any of this trouble should return as a result of injury, I will make no claim for it."

The trouble is—more correctly, the fact is—that the law permits no such stipulation to be made. As Mr. Ellerd just read, in an extract from the statute, no one but the Industrial Commission itself can permit any change whatever in this law. The willingness of the applicant doesn't help one particle. And for that reason, as well as others, I agree with the essayist of the evening, that the Workmen's Compensation Act should be amended so that men who have physical defects which are not disabling may get jobs, may return to work, without the employer being penalized for giving them work.

DR. EDWARD C. HOLMBLAD: I have been following this subject for several years and I have been watching the various interpretations put upon its phases. And always I see before me that group of individuals who have been denied employment because of an interpretation of the Workmen's Compensation law that the originators of that law never intended.

As I understand the Workmen's Compensation law, it was designed for the purpose of permitting the families and children of injured workers to have food and livelihood during the disability period. Certainly, the proponents of this law could not have foreseen this by-product that has developed in the last few years; this culling out of a group of workers who can not be employed because of what the employers are penalized for in hiring them.

A year ago we began to have assemblies to talk this over. We asked ourselves: "How shall we approach this problem?" I am happy that we have this turn-out tonight to hear the paper and its discussion, emphasizing, as they do, what everyone who is engaged in industrial medicine and surgery knows, that this is a very concrete problem. All of us, as well as the many who have expressed their opinions to me in my conversations with them during the last year, are anxious to do something about it. But how to do it? Where to begin?

As an example, when a man is employed at the age of 55 or 60 for a period of a month and during that time he develops a cerebral hemorrhage in doing the kind of work he has been doing for many months or years, it is not fair to charge the industry that offered that man employment because the cerebral hemorrhage that caused the death, or the loss of use of an arm or leg, has been a cumulative one over many years.

I could go on talking about this for a long time, because I am hoping that out of this Conference will come some concerted effort toward amending our law, or that something will be done to help this unfortunate group.

I had the experience about a year ago of examining a man who came in for employment, and I told him to take off his clothes. I went about some other business, and when I came back he had taken off his clothes to his waist. I said: "What is the matter? I want to see how things are." He replied: "I thought I could get by, just taking my clothes off to the waist. I have a bad-looking leg here." His leg had a hideous disability, as a result of an automobile accident not due to employment. The number of automobile accidents is constantly increasing the number of disabilities. We can not possibly employ that sort of individual at the present time.

Again, therefore, I express the hope that out of this group, and out of this discussion, we can formulate in our Association a committee whose purpose it will be to take under consideration this very vital problem, and render us reports from time to time. This would be a start, at least, toward some very constructive work.

I still see before me, and I want you to carry away in your vision, that same group of individuals who are entitled to earn a livelihood and at the present time are denied the right to earn it because of a by-product of our Compensation Act that was never intended to have the effect of such denial.

DR. IRVING GRAY (New York): I wonder if it would be possible to get a list of these employees who can not be employed, have them properly represented, and let them make a request.

MR. ELLERD: I think Dr. Gray's suggestion is most timely and wise. Nobody has as much at stake as these people who are thus barred from employment, and there is no one whose voice would speak so loudly to the people who are barring them from employment. If there is a practical way to get them together in such representation, and they might be encouraged to promote it, there would be a beginning point. But I still think there has to be some motivating force, such as this Association, to marshal these people and direct and help them in bringing about this necessary change. But I also think that the actual results of this unfairness and injustice would speak louder than anything said by even such a group as this.

CHAIRMAN SAWYER: In New York State recently the State Department of Health addressed a letter to the associated industries of the state, asking if they will make a study of this problem, specifically with regard to tuberculosis. It is hoped that out of the survey which the associated industries are now making, they having voted quite a sum of money for the purpose, some concrete suggestions will be made. Isn't that a possible method of approach?

DR. J. E. STANTON (Chicago): Those of us who have to sit down and talk to these chaps whom we have to put in a classification so that they can not be hired appreciate the fact that the situation is precisely as Dr. Holmblad describes it. It is, indeed, a problem.

I know that Armour and Company have some handicapped men, and that they are taking care of them, and that those men are producing. When Mr. Ellerd says there is no reason why such men shouldn't be allowed to earn a living, he is speaking from experience.

DR. HOLMBLAD: Possibly someone can tell us how effectively the waivers work in those states where they are being employed.

DR. R. R. SAYERS: The waiver is in effect in Connecticut, and is being used, and seems to be working satisfactorily. However, there is one other feature that might be taken into consideration. Sometime ago we agreed to examine 75,000 individuals. Of that 75,000, about 65% were found to be suitable for any kind of work; about 25% had to have some statement from the physician as to the type of work they could do; and about 7 or 8% needed conferences between the foreman or supervisor and the physician as to their limitations.

There were less than 1% who were unemployable, according to those examinations; and we thought we did a fair job in making the examinations. These people were hired by the United States government, and we have a compensation law that covers all illnesses due to occupation and all injuries.

So, for us, it has not been an insurmountable problem. I believe we can work out a plan to handle it.

DR. A. S. LEVEN: I am absolutely in accord with the idea that this is the place and this is the body which should take the initiative in this type of work. We, as

physicians and citizens, would like to see those who are deprived of work get work, and we should go on record with a resolution recommending the amendment to the present compensation law. Possibly we can get the various labor bodies, like the unemployment council, interested in this resolution, in this way stimulating the legislature into amending the law.

DR. C. W. WINSOR (Detroit): I would like to have Dr. Selby tell us, if he will, his impression of the value, if any, of our waiver provisions covering or attempting to cover hernia and silicosis.

DR. C. D. SELBY: The waiver in Michigan was a temporary measure which was effective only during the first 90 days following the passage of the occupational disease law. It gave the employers the opportunity to secure waivers from workmen who had silicosis and hernia prior to the passage of the Act. It was merely a temporary procedure. I might add that recent conversation with representatives of the Compensation Board in Michigan leads me to think that the Board is considering the advisability of recommending the passage of an act providing for waivers in Michigan.

While I have the opportunity I wish to follow through on some remarks made by Dr. Sayers. I appreciate the masterly presentation of Mr. Ellerd and the discussion that followed, but I fear we give this subject an importance beyond what it actually merits. We have many plants of our own where the percentage of rejections is very low. For example, I recall one plant right now where we have 900 hernias. We are perfectly willing to assume the risk. I believe you will find that employers throughout the United States are accepting handicaps with full knowledge of the possibilities of compensation costs, and doing it solely for the purpose of assisting men of that type to secure an honest living.

Thus I do not think the impression we are getting here tonight is representative of the general situation. On the contrary, I would like to call your attention to the fact that —according to Dr. Newquist's figures—the amount of time the average employee of a well organized industrial establishment loses because of occupational diseases each year is about one one-hundredth of a day, while, because of occupational accidents, he loses six-tenths of a day. Dr. Sayers has told us, and Dr. Newquist confirms this, that the average workman loses each year because of non-occupational sickness and injuries, from eight to nine days. Our real problem, therefore, is in the maintenance of health.

CHAIRMAN SAWYER: I would like to entertain a motion that a committee be appointed by the President of this association to consider this problem in all its many aspects.

[The motion was made by Dr. Winsor, seconded by Dr. Leven, and was put to a vote, and carried.]

MR. ELLERD: I want to say that I fully agree with Dr. Selby that our major problem is the preservation and development of real health among employees. And I hope I haven't left any exaggerated idea that there is any tremendous proportion of the total number of industrial employees who can not be employed because of physical disability. I did not intend to convey any such thought. But I do say there is a considerable group of such people. How large it is I do not know. They are in a pool somewhere, trying to find work, and they cannot find it. Their aggregate is growing larger every day, and it is growing larger because of an unfair interpretation of law which, as Dr. Holmblad said, was never intended to exist. It was never intended that the employer should be the insurer of everything that might happen to an employee anywhere. It was only intended that the employer should pay for the diseases and accidents that he caused, and for their results and those alone.

I haven't intended to exaggerate the problem, but I do insist that there is a great injustice being done to a large group of people in this respect.

Discussion of Fat Embolism

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Chicago

THE subject of fat embolism has always enjoyed a very hazy ill-defined concept, where many ill-founded opinions and erroneous ideas have held the spotlight. This is really not the fault of the medical profession, but of the nature of the disease. The literature is full of case reports which might very well be true cases of fatal fat embolism, but they do not stand under careful scientific analysis.

The diagnostic means at our disposal are few and not always reliable. Many of the methods require a special technic not known to the average man.

Experimentally it has been shown that dogs can be made immune to many times the lethal intravenous dose of liquid fat by repeated increasing doses. Whether an emulsifying or digestive ferment develops is not clear; although the thought is perhaps fantastic at this time, it may be said that should clinicians be able to diagnose the condition with definite accuracy, many lives might be saved by the development of an emulsifier or digestive ferment for the disease.

For this reason the author has spent a number of years working on the experimental diagnostic phase of this malady.

General Survey

HISTORICAL OBSERVATIONS: As early as 1669 Lower had injected milk intravenously in dogs, and this was probably the beginning of the knowledge of fat embolism. Magendie, during the years 1821 to 1836, did some experimental work on hyperlipemia and its effects on the circulation in animals. His description of the experimental introduction of liquid oil into the venous circulation is classic. Zenker, in 1862, observed the first fat emboli in the pulmonary capillaries of man after a severe crushing injury to a railroad worker. The pulmonary capillaries were seen to contain a great many emboli of fluid fat. He thought that they occurred by aspiration from the stomach through the gaping hepatic veins.

Scriba, in 1880, reviewed all the cases up to date and then added 34 of his own. He also conducted experiments on animals and brought forth many clinical and pathologic points which had previously been obscure. Most of the discussion of fat embolism in modern textbooks is based on the statements and conclusions which he drew. However, years have shown that some of his opinions were erroneous. Fatty embolism could be regarded as causing death in only 14 of 177 cases,

and in some of these he considered the cause of death doubtful.

Lehman and Moore (1927) by *in vitro* experiments showed that histamine extracted from necrotic muscles produced a rapid disintegration of the emulsified fat of normal blood serum. They concluded that fatty embolism might be readily produced in the bone marrow on a non-traumatic basis purely by the absorption of histamine from injured tissue into the blood stream. They also showed that intravenous injections of ether produce fatty embolism of the lungs by dissolving the normal emulsified fat. When the gaseous tension of the ether was lowered by evaporation in the alveoli, the free fat became visible microscopically in the blood.

ETIOLOGY: The experimental work done on the causation of fatty embolism has been considerable and in many instances has led to much contradiction and confusion. Men are much more frequently affected than women, the proportion being about 8 to 1. The age at which the condition most commonly appears is the fourth decade of life. Rarely does it occur in children, because the fat in the bone marrow is insufficient to cause it up to the fourteenth year. Landois, in an excellent article on the subject, stated that he found mostly palmitin and stearin in children and infants, with a smaller proportion of the more fluid olein. At body temperature oleic acid is fluid and is more easily absorbed than the more viscous palmitic and stearic acids. For this reason fatty embolism is not so common in children.

Lehman and Moore calculated the amount of fat in the marrow of a femur and found it to be approximately 65 cc. By experimental study with cottonseed oil they ascertained that if man is able to tolerate as much oil in the blood stream as a dog, 120 cc. would be required for a lethal outcome. If this is true, all the fat in the bone marrow of a femur could be well tolerated. There has been a great deal of controversy as to whether the fat is carried by the blood or by the lymph vessels. The present opinion seems to be that most of it is carried by the veins while a smaller part may be carried by the lymphatics.

It is interesting to note that experimental animals can be made to build up a resistance to experimentally induced fat embolism by repeated small injections of fat. This work was done primarily by Paul and Windholz and later by Domanig. They noted that such animals could withstand many times the lethal dose. No droplets of fat could be found free in the blood serum of these animals. Evidently such droplets are rapidly destroyed by a newly formed unknown substance.

PATHOGENESIS AND PATHOLOGIC PICTURE: After an injury to the fat of the bone marrow or adipose tissue, fat is liberated by the disintegration of the supporting fibrous tissue. Naturally there are ruptured blood vessels in the vicinity of the injury. The arteries squirt more blood into the area, thereby increasing the pressure, while the veins remain open and absorb the fatty mixture by venous suction, particularly if its consistency is more or less fluid. Gauss brought out the point that fatty embolism is more common with fracture than with any other condition because the veins are encased in a bony wall. Hence they cannot collapse as elsewhere in the body but remain wide open for the admittance of the fatty mixture. This process may take place immediately or proceed for some time until coagulation occurs. This pathological condition involves all the organs of the body and is too well known by all to be discussed in this brief resume.

Lehman and McNattin noted that fatty embolism is present in the lungs of about 50% of unselected cadavers. These men have conclusively shown that anatomically the diagnosis of fatty embolism as the cause of death cannot be safely made. Wright observed fat embolism in 52 of 100 consecutive patients examined post mortem, the majority of whom did not suffer from fracture or contusion as a result of a fall or some other accident. He also helped to substantiate the contention that postmortem observations of fat embolism are not pathognomonic evidence of violence.

Carrara noted fat embolism in 22% of cases of cardiovascular-renal disease and 44% of cases of burn. Catsaras reported fatty embolism in the lungs of 18 out of 67 patients with post-influenzal pneumonia. To add to the already great confusion on the subject, acidosis, phlegmonous gastritis, acute pancreatitis, chronic tuberculosis, menstrual suppression, hepatitis, splenitis and tuberculous pneumonia, in fact, almost all diseases, poisonings and infections to which the body has been subjected, have been reported in the literature as having caused fat embolism at one time or another. Vance, in 1931, wrote a comprehensive paper on fat embolism from a pathologic point of view, which is a classic in the present literature on the subject.

SYMPTOMS: There is no clinical correspondence between the apparent injury and the degree of resulting hyperlipemia. Injuries apparently identical may in one person be followed by a fatal hyperlipemia and in another cause but a slight disturbance.

The onset may be sudden, within a few hours of the injury, but usually does not become manifest until the third or fourth day. Once the symptoms set in, they may vary from a slight irritability and excitability of the patient to maniacal periods associated with high grade delirium, and death. If the symptoms are watched carefully, it is seen that they have a tendency to be cyclic. The cycle corresponds to the passage of the emboli from the pulmonic circulation to the systemic and their gradual return. Many patients with hyperlipemia appear to be doing nicely when gradually they begin to show signs of nervousness and excitability. At this time the pulse rate and temperature begin to show a slight rise. The rate of respiration shows a more rapid rise than that of the pulse, and even early in the development of the symptoms it may be dyspneic. As more capil-

laries are obstructed in the lungs, the dyspnea increases correspondingly. Cyanosis may or may not appear, according to the extent of pulmonary impairment. Gradually a passive congestion occurs in the lungs and moist rales are audible over the bases. A cough begins to appear and is of a productive nature, rarely bringing up blood-stained sputum, however. For this reason, in many of the cases the diagnosis is bronchopneumonia.

As the pulmonary arterial pressure increases, the heart must beat faster in order to overcome the circulatory resistance. The pulse rate becomes faster and stronger, and the blood pressure begins to rise. If the resistance in the pulmonic circulation increases or remains great, the heart before long begins to weaken. Its rate increases while its force decreases. The blood pressure correspondingly begins to fall. If some of the emboli lodge in the coronary vessels, the cardiac failure comes on much more quickly. Before long, the pulse becomes imperceptible, the arterial pressure falls, the venous pressure rises and the picture of deep shock and cardiac failure appears. The temperature varies from subnormal to 106 or 107 F., according to whether or not the heat-regulating center is disturbed by the emboli. The usual temperature during the height of the disease is about 103 F. In the terminal stage the temperature often rises much higher.

Petechial hemorrhages may appear in the skin, as in any other disease in which the embolic phenomena predominate. However, because the capillaries are not actually occluded, as in bacterial endocarditis, but the circulation is greatly slowed by the increased viscosity of the blood, they are rare.

Diagnosis: In the majority of cases of fat embolism the condition is so mild that it does not cause symptoms or so severe that death results in a few days from involvement of the lungs or the brain. During life the diagnosis of fat embolism is justified only if there is a history of an injury and of the typical clinical manifestations. The incubation period varies from a few hours to three or four days from the time of the accident. It is a good point to remember Dennis' rule in this respect, in spite of the exceptions: shock, three hours; fat embolism, three days; pulmonary embolism, three weeks.

Additional confirmatory signs are the presence of fat in the urine, the occurrence of fat emboli in the retinal vessels as demonstrated by the ophthalmoscope and the appearance of petechial hemorrhages in the chest, shoulders and neck. The presence of the large circular cells of Elting and Martin or the fat globules of Warthin in the sputum is not a pathognomonic sign, as they are found in conditions other than fat embolism. As a rule, fat embolism is rarely diagnosed from clinical signs and symptoms; it is most often discovered accidentally at necropsy. In the differential diagnosis delirium tremens, fracture of the skull, bronchopneumonia and shock must be most seriously considered.

Prognosis: The prognosis of fatty embolism should always be reserved, because some of the patients who appear to be progressing satisfactorily die suddenly. As to expectation of life, most of the patients recover, but because in only the fatal or very serious attacks is the diagnosis made and the mild attacks are overlooked, most people have the reverse opinion.

Treatment: As fatty embolism associated with fracture is not of common occurrence and is rarely diagnosed when it does occur, one can understand why the literature on the treatment of this complication is not illuminating. Grondahl stated that a terminal result occurs in but one of every 3,000 cases and that death following fracture can be attributed to fatty embolism in only 1% of the cases.

The suggested treatments of this condition, in a review of the literature, have varied from canaliculizing the thoracic duct and intravenous injection of sodium bicarbonate to form a soluble soap with the fat droplets (with resulting death in all experimental animals) to management of the symptoms as they arise.

To mention in detail the great number of advocated therapies would only add confusion to an already over confused phase of the problem.

As yet we have no rational therapy.

Value of Chemical Analysis of the Blood and Physical Means of Determining the Quantity of Fat

SINCE the problem of fat embolism has to do with the presence of droplets of fat in the blood stream, it was thought that quantitative determinations of fat in the blood would be of material aid in its diagnosis. For this reason the known methods were looked up and studied in great detail. Kumagawa and Suto described a saponification method in 1908. Bang in 1918 described an extraction method, which however is not accurate enough to be truly scientific. Bloor, Pelkan and Allen first brought the nephelometric method to the foreground in 1922. Later, in 1928, Bloor published an account of an improvement on this method. Stoddard and Drury described a titration method in 1929.

After a careful study, counsel was sought from several well known physiologic chemists, and all agreed that it is beyond the ability of the average part time chemist to carry out these methods with perfect accuracy. Even when the determinations are done in well equipped laboratories by properly trained men, the variations are so great as to render them of no real diagnostic value. For the present at least, the outlook along these lines is unfavorable. Clinical investigation in the serologic department of the Cook County Hospital has revealed many blood serums of almost cream-like appearance. These were from patients suffering from diabetic coma, persons with lipoid nephrosis and lactating women. In spite of the fat content of the blood having reached this startling height, these patients revealed no manifestations of fat embolism. Some investigators have

noted in cases of diabetic coma that the concentration of total lipoids in the blood has reached 26%, although the normal concentration is only 0.4%.

These observations, therefore, have conclusively proved to me that it is not the total fat content of the blood in which one should be interested, but the state in which this fat occurs. If it is in the form of a stable emulsion, no fat droplets are present in the blood, and therefore no embolism can occur. On the other hand the corpuscular fat content is of all importance, as it causes the occlusion of the vessels which produces the embolic phenomena. Unfortunately, only 5% of the total fat content of the blood is found in this form. If one considers that the total fat content, as has been stated before, is only 0.4%, one realizes that corpuscular percentage almost approximates zero. Therefore, it stands to reason that any total chemical method for determining increases or decreases of this substance would be far beyond the scope of quantitative chemical determinations, as the percentage of error introduced by the best present day methods would be too great.

Other fields of experimental work were sought for possible aid in determining the fat content of the blood. The use of the spectroscope was suggested. However, both a physicist and an excellent physiologist stated that the concentration of fat was too small to produce any appreciable variations. At a later date the possibility of measuring electric conductivity in order to determine changes in fat content of the blood serum was discussed. This method as well as the use of the polariscope received negative comment and was abandoned.

Results of Dark Field Examinations of the Blood in Case of Recent Fracture and in Control Cases

EDMUNDS first described the dark field examination of the blood for particles of fat in 1877. Further work along these lines was carried on by Neumann in 1907. Gage and Fish in 1924 published a most excellent article on this subject, describing investigative work on absorption and assimilation of fat in the lower animals. The senior author was the first to give the microscopic particles of fat in the blood the name of chylomicrons (1920), meaning that they are 1 micron in diameter and are composed of chyle.

A control study of 25 miscellaneous blood serums from the medical wards of the Cook County Hospital was undertaken. No variations from the normal were found. Several creamlike specimens of blood from a lactating woman yielded a few interesting observations. In spite of a cholesterol content of 335 mg. per hundred cubic centimeters and a milky serum, no actual droplets of fat could be seen, a phenomenon which shows the marvelous stability of the emulsion of the blood serum.

As the average blood cell is 10 microns in diameter, it has been estimated that in order to occlude the finer capillaries of the lung the droplet of fat must be at least 12 to 15 microns in diameter. In none of the control cases were droplets of this size noted. In order to show the feasibility of this diagnostic method in cases of embolism, olive oil was injected intravenously into a dog. Five cubic centimeters was injected slowly. Two minutes later, with a clean syringe and needle, a cubic centimeter of blood was removed from the leg opposite to that in which the injection had been made. When a drop of this blood was examined under the dark field, ameba-shaped droplets of olive oil, at least twice the diameter of an erythrocyte, could be easily demonstrated.

Excretion of Fat Droplets Through the Kidneys

THIS experimental work was undertaken to determine whether or not intravascular fat ever was excreted through the kidneys, and if so what amounts were necessary for its detection.

This problem was approached by injecting various oily substances, in various physical states, directly into the renal artery, then collecting the urine directly from the ureter which was cannalized and brought out in the loin.

It was found that microscopic fat droplets could be detected after centrifuging the urine and staining the supernatant liquid with Sudan III. Low power and also high power examinations of the urine were necessary.

By working from half the lethal dose (1.1 cc. of oil per kilogram body weight) in dogs, it was found that even 0.01 cc. of fat injected into the general circulation was sufficient to give a few microscopic fat droplets in the urine. However very careful examination of many high powered fields was frequently necessary.

Just how the fat was secreted was unknown. As the frog's kidney has one blood supply for the glomerular system and another for the tubular system, giant bull frogs were used, after the method of Cullis. After 18 experiments sufficient evidence was accumulated to prove that only the tubular system excreted the fat droplets and none came through the glomerular system.

In order to prove or disprove this observation, the proximal convoluted tubules of the dog were destroyed by the injection of 2 milligrams of uranium salt per kilogram body weight, after the method of MacNider. After eight to 10 days the dogs were injected with moderate sized doses of intravascular fat which in the above mentioned experiment gave overwhelming fat droplets in the urine. In six experiments four dogs had absolutely no fat excretion although plenty of urine was excreted, one had a few droplets and one had a moderate number. In the last two animals microscopic sections of the kidneys showed a few normal convoluted tubules present, thereby showing that all the tubules had not been destroyed.

Other experiments on quantitative fat excretions were undertaken. The animals were given a known amount of intravascular oil, and then all of the urine was collected in metabolism cages for 48 hours. The urine was then extracted with ether. In no instance was it possible to collect any macroscopic amount of oil.

This experiment conclusively showed that the fat excreted in the urine is always microscopic and never macroscopic, as most authors would lead one to believe. The percentage of the total intravascular fat excreted in the urine is very small, the rest being picked up by the recticuloendothelial system and liver, and utilized by the body.

Technic or Analysis of Urine in Cases of Fat Embolism

IN THE study of this problem, I have examined several hundred specimens of urine for the presence of fat in suspected cases of fat embolism. After a period of time, it was observed that this apparently simple investigative phase of the problem presented an interesting physical phenomenon. Since this phenomenon heretofore has evidently not been emphasized, its investigation was undertaken. That fat is excreted by the kidneys in the urine of patients suffering from fat embolism is well known and often spoken of in the literature. But unfortunately the detection of fat in the urine is difficult because of one very elementary physical phenomenon. The droplets of fat float on the surface of the urine and therefore are not excreted from the bladder unless the last few cubic centimeters of urine are expressed. For this reason in many cases in which the urine contains fat, the specimens examined give negative results because this simple fact is overlooked. Jirka and I, in 1936, conclusively showed this, both *in vitro* and in clinical cases. Oleic acid was injected into the pelvis of the kidney after a retrograde pyelogram had been made. It was noted several hours later that all of the injected oil could be collected from the last few cubic centimeters of urine, while the remaining 200 to 400 cc. of urine was free from fat.

A Control Study of the Urine and Blood of Patients without Embolism

UNTIL Jirka and I took up the study of cases of non-traumatic conditions, no investigation of the urine and blood in such cases was ever carried on. An examination of 200 miscellaneous specimens of urine and blood in the Cook County Hospital failed to reveal a single instance of droplets of free fat in the centrifuged specimen of either the urine or the blood. Eleven of the specimens of blood showed chylous emulsion, but it was physiologic, for the blood had been drawn within an hour or two after the ingestion of a fatty meal. We next studied fluids obtained in 50 cases of fracture from one to 144 hours after the accident. In not a single instance were we able to find any free fat droplets in specimens of either the urine or the blood.

From the work just described it may be safe to assume that the presence of droplets of fat (larger than a chylomicron) in specimens of either the urine or the blood is indicative of free intravascular fat, which is consistent with fat embolism. However, the examination of these liquids requires long centrifuging, staining of the supernatant liquid with Sudan III and careful study of the fluid. Many trials are necessary before one learns the technic.

The Value of Surface Tension Determinations for Diagnosis

SINCE the intravascular fat in fat embolism is disseminated throughout the entire vascular system, a specimen of blood from the cubital vein should be characteristic of the entire blood volume. As fine droplets of oil would affect the surface tension of the blood serum, studies along these lines were undertaken.

The surface tension of water at room temperature was found to be 85.8 dynes, while that of human serum 90.5 dynes. If olive oil was added to the serum in proportions of 224 cc. of oil to 5000 cc. of blood the surface tension became 77.75 dynes, a very noticeable difference. However this is more than twice the lethal dose in man. If the proportion was reduced to 151 cc. of olive oil to 5000 cc. of blood the reading became 82.75 dynes, a noticeable difference from the normal of 90.5 dynes.

At first this appeared to be a worth while method, however when variables produced by, standing of the specimens, temperature changes, and the time of day the specimen was drawn, were studied, the method was found to possess too many uncontrollable variables for any definite scientific use. Controlled experiments were carried on in dogs with very little positive success. Hence this method was discarded as being of no clinical value.

The Value of Roentgenograms of the Chest in the Diagnosis

IN AN attempt to bring further aid to the diagnosis of this condition, Jirka and I proved by experimental work on dogs that roentgenograms of the chest show definite changes in the lungs after intravenous injection of oil. This work will be carried on in human beings when the opportunity presents itself. As far as I know, the roentgen ray has never been used as an aid to the diagnosis of fat embolism. For this reason I am presenting for the first time an evaluation of the use of roentgenograms of the chest for this purpose. Eleven dogs were used in the experiments, animals weighing close to 12.5 kg. being selected whenever possible. Sterile oleic acid was given intravenously to six and sterile olive oil to five of the animals. Varying doses were used. One must not lose sight of the fact that fat embolism is not a true embolism in the sense of a permanent occlusion of a vessel. It is simply a retardation of the flow of blood through a capillary while the droplets of oil become elongated and are slowly forced from the arterial to the venous side of the circulation.

Conclusions

QUANTITATIVE blood chemistry determinations are of no value in the diagnosis.

2. Spectroscopic, electrical conductivity, polari-

scope, and surface tension determinations of the blood serum are of no value.

3. Dark field examinations, and Sudan III examinations of the blood serum are of definite aid in the diagnosis.

4. Intravascular fat is excreted in the urine, however the only method of detection is microscopic examination of the centrifuged stained specimen.

5. In the examination of the urine in suspected cases only the last few cubic centimeters of the catheterized specimen are of value.

6. Intravascular fat droplets if present in sufficient quantity will always produce lung changes detectable by x-rays.

Discussion:

DR. W. R. CUBBINS: This very fine paper represents our struggles in an attempt to make a diagnosis. It is a peculiar thing as to the frequency with which these conditions are found.

Dr. Hirsch, at St. Lukes, who was a pupil of LeCount, is an avid searcher for fat embolism in postmortems. There he finds it, and with a frequency that is startling. It is not so common in our cases at the County Hospital.

The coroner's physician looks at the subject before him. He had an accident; he is dead; and that is adequate. Now that is far from being adequate. We must go further. We must analyze these cases of trauma and sequential death from many different angles before we will be competent diagnosticians.

If we get a postmortem, then it is extremely difficult to have worked up, with their peculiar technique, the serial sections that are so frequently essential to show this condition.

In the County Hospital we have had a few cases which have intimated an intestinal obstruction from fat embolism. We have had cases at St. Lukes' that have had definite and positive intestinal obstruction, with each and every one of the terminal vessels blocked with fat. An interesting proposition has been that these individuals with intestinal terminal vessels blocked with fat have yielded very few, if any, findings in the cortex. In other words, there are certain determinant chemical facts which cause fat to have a certain kind or degree of selectivity.

Now that brings us back to the work at the County Hospital: Bessley, and this young man Bisson. When they started out the idea was to differentiate this condition from alcoholism. That was found to be extremely difficult; when the injured individual has had more or less excessive amounts of alcohol previous to his injury, he is far more liable to go into the delirial state following his injury than the individual who has not been an imbiber of alcohol.

You hear a great deal about pneumonia coming from trauma, and it has been an interesting thing here also. At St. Luke's we have had one fractured femur after another, with multiple pulmonary emboli and bronchial pneumonia with the sequence of death. At the County Hospital, in the individuals with fractured neck of the femur, bronchial pneumonia has been an unusual thing, far from common. It is so uncommon that we do not feel that it is essential to get this particular type of people up, to make an early locomotion. It has not been essential at that particular hospital. Yet at St. Luke's there were three old ladies, one right after the other, with bronchial pneumonia due to multiple fat embolism, followed by death.

These alternatives of clinical observation are just as confusing as Dr. Scuderi's very wonderful presentation of this subject points out. I can not thank Dr. Scuderi enough for the breadth of knowledge that he has shown and the work that he has done along this line. But it is this particular association between chemical knowledge and clinical research that must be constantly coordinated in order that we solve some of these difficult prob'ems.

Pectin in the Treatment of Infected Wounds

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FOR the pre-operative preparation of the skin the antiseptics and germicides universally approved as adequate are, by their chemical make-up, not only bactericidal but often have a corrosive, coagulative and destructive action on the tender muscle, nerve, and bone and joint structures with which they are brought in contact. They have, therefore, no place in an open wound, infected or potentially infected, and their appropriateness should never be confused in this regard. The vicious probing, and the splashing of strong tincture of iodine and other proprietary antiseptics into the furthermost recesses of a compound fracture have long since been discarded by the most thoughtful traumatic surgeons. In this more highly civilized time of scientific understanding we are content to handle tenderly the exposed compound area, and carefully cleanse the wound with ordinary soap and water, applying our favorite approved antiseptic to all of the parts on the surface, and to only those parts of the wound that are to be removed by ultimate conservative debridement—thus not increasing the area of trauma by insult with chemical substances that coagulate and kill virile living tissue. The mere fact that a certain antiseptic has been proved absolutely germicidal by laboratory experiment does not license its use under the skin surface, either as a cleansing or a therapeutic agent, in the treatment of infected wounds.

Nature, in her efforts to perpetuate life's processes, has ever maintained quite an elaborate experimental laboratory. Since the advent of complicated organic life, nature throughout the ages has contributed considerably in the development of defense forces in her fight for the survival of the fittest against infection and disease. During this evolution she has created in the tissues secretions, reactions and highly specialized cell structures with an elaborate defense mechanism, to combat not only the degenerative forces of life's program but also the onslaught of bacterial invasion. The successful use of vaccines, serums and viruses is but man's helping hand in the intelligent utilizing of the fruits of nature's investigative genius by further activating these normal defense mechanisms. The old idea in medicine that we must find a chemical formula, a favorite prescription, a drug, syrup, salve or liniment for every human ailment has long since fallen from its therapeutic pedestal.

The outstanding advances in medicine and surgery of this era have been through man's dabbling in nature's laboratory, in the form of stimulating and aiding the defense mechanisms of nature's normal processes.

Not alone are vaccines and viruses in this group, but also among these is the importance of dietary regime in gastro-intestinal disorders, endocrine therapy and its various ramifications, allergic desensitization, the importance of rest in heart, lung, visceral and joint disease, hyperpyrexia, mechanical stimulation and exercise of impaired circulation in the extremities. And not the last or least of these has been the recognition that adequate drainage and non-interference with the normal tissue defense are vitally essential to the successful treatment of infected wounds. Therefore, the use of an antiseptic that kills, coagulates, corrodes, injures or washes away the living tissue of a wound or its secretions, rich in defense healing properties, is to be condemned as a therapeutic measure.

Such use causes so much destructive action that it leaves fresh fields for bacterial cultivation unprotected.

It is not the purpose of this introduction to place pectin therapy for infected wounds on a purely defense mechanism theory, but our clinical observations have led us to suspect that this phase is important. Pectin is almost universal in plant life, serving apparently as an intercellular mortice. It is found in abundance in apples, bananas, and most other fruits and in vegetables. Its important place in plant structure is perhaps responsible for the apparent defense reaction it exhibits against bacteria and the stimulating effect that it exerts in the healing process of wounds. The chemical formula is mono-arabinose mono-galacto diacetyl heptamethoxyl octogalacturonic acid, with the resulting split products of arabinose, galactose, methyl alcohol and galacturonic acid. It is manufactured commercially as a fruit preservative and jellying substance. There is a vast difference in the products of various manufacturers. For the treatment of infected wounds the flake pectin of the Sardik Food Products Corporation and that of the General Foods Corporation seems to give the best response in the tissues. From a bactericidal standpoint we have been led to feel that the Sardik pectin is the more potent, while both the Sardik and the General Foods pectin seem to have an equally favorable influence on the healing of granulation tissue.

My interest in the use of pectin came through the suggestion of Dr. George Covey, with whom I became associated in the treatment of a child who had had a burn some 10 months previously, which involved her neck, upper arm, axilla and entire back, and on whom I had attempted several unsuccessful skin grafts. Gradually, under treatment with pectin alone, the entire area has completely filled in with healthy scar tissue. Prior to starting the treatment we went into the literature and found that a young man, Dr. Charles A. Tompkins, a graduate of Nebraska, formerly of the University of Indiana Medical School, and now associated with the Ford Hospital in Detroit, had considerable to say about the use of pectin in the treatment of infantile diarrhea. Also, he had made some bacteriological observations which led him to the conclusion that the bactericidal effect of pectin varies inversely with the pathogenicity of the organism. Thus, the Shiga dysentery organism is killed in a few hours, and the Flexnor in a little longer, while the Sonne is quite resistant. In his experiments he found that the streptococcus was killed very easily, while the staphylococcus was quite resistant. He found that the bactericidal affect of pectin was influenced by heat and oxygen, that it would withstand autoclaving at 15 pounds for 20 minutes and still maintain its bactericidal properties, and that if not kept tightly sealed it turned yellow and ineffective. In alkaline media it breaks down and the effect is lost if the pH is above 5.5. The liver manufactures glycuronic acid as a part of the body's chemical defense mechanism. Among the split products of pectin is galacturonic acid, which is an isomere of glycuronic acid, and may form a factor in the apparent defense action of pectin in infected wounds. Dr. Tompkins believes that possibly the large pectin molecule envelops, or starves the bacteria, because it absorbs 20 times its weight. Its acidity, viscosity, and hydroscopic properties probably are factors in this process.

Clinical Observations

THESE observations have been collected not only through my efforts but also those of the Pectin Committee of the Lincoln General Hospital, at Lincoln, Nebraska, the clinical laboratories of the Lincoln General and Bryan Memorial Hospitals, and the enthusiastic cooperation of my colleagues, particularly my associate, Dr. C. F. Ferciot.

1. We believe that the healing time of an infected soft tissue wound, pressure sores, ulcers, osteomyelitis, compound fractures, burns and the like, is markedly reduced by the proper administration of pectin solution as a dressing.

2. Instead of the foul, putrid odor emitted under certain approved forms of treatment, the pectinized wounds smell fresh and clean.

3. Instead of profuse, purulent discharge, within 24 or 48 hours the wound has become non-purulent and clean looking. The pectinized gauze seems to absorb the decomposed material and debris, and the wound becomes non-purulent and clean looking with rapidly healing, healthy, bright granulation tissues, which are flat and cling firmly to the under surface as compared with the purulent, foul, anemic, raised, unhealthy granulations seen in most instances.

4. Pectin seems to stimulate the formation of healthy granulations, and at the same time discourage excess, anemic granulation.

5. Instead of the piled-up scar there develops a smooth, level, epithelialized surface.

6. We have noted that in osteomyelitis sequestra seem to break away and are pushed out more rapidly than in other forms of treatment.

Technique

BURNS: Every 24 hours the dressings should be gently removed, and the area rinsed with warm water or normal saline solution, then covered with three or four layers of two- or three-inch gauze bandage. With a bulb syringe a 2% pectin solution is floated into the gauze sufficiently to completely moisten it, and the area is covered with oiled silk. Every four or six hours, depending upon the absorption or drying, the dressings should be moistened. Within a few days sloughing areas will disappear or be washed off. The pungent, purulent discharge will disappear, and firm, level, healthy granulation tissue will develop and a flat scar tissue will appear along the edges. In a relatively short time, under ordinary circumstances, scar tissue will form or skin grafting can be considered, should it be necessary.

PRESSURE SORES, ETC.: These are treated exactly like burns. We have noted, however, that they heal more rapidly and with less defect and skin deformity.

OSTEOMYELITIS: Both acute and chronic osteomyelitis may be treated with pectin. For the successful treatment of all infected wounds by this method it is absolutely necessary that the area be wide open, as it is difficult to carry out the technique if there is pocketing and sinus formation. Therefore, in the preparation of an osteomyelitis case for pectin treatment adequate operative drainage and clean-up are essential. The wound is then filled with dry gauze, not packed tightly, but just sufficiently to place the gauze in contact with all parts of the wound. One or more perforated, small rubber tubes is embedded in the gauze at the base of the wound. The tubes and the gauze are then saturated with 2% pectin solution, covered with dry dressings, and a bias flannel bandage with mild compression is applied. Sheet wadding and felt, followed by plaster of Paris, are applied to the extremity, fixing the joints above and below the site of disease in the position of election for optimum function. After 24 hours the plaster cast is generously fenestrated, exposing the dressings. The tubes are located and pectin is instilled. The superficial dressings are saturated. This procedure is repeated every 24 hours. The fenestrated area is bandaged and the extremity is suspended appropriately in bed. After about a week the dressings are removed and the wound repacked. After the first dressing the wound is not disturbed until appearance and debris make further clean-up essential. Usually dressings should last from one to three weeks. The pectin solution used in a dressing after an operative procedure seems to have a local hemostatic affect, as these osteomyelitic wounds do not hemorrhage as extensively as those dressed by other methods. There is little pain and discomfort from changing the dressings of these wounds, as there is not the tendency to adhere to the granulations. Due to the fact that there is no swabbing out of the wound with antiseptics during the change of dressings, the granulations are not disturbed and there is no bleeding. The putrid, decomposing odor so often evident in osteomyelitis is seldom contended with. In a short time the wound is relatively non-purulent and without discharge or pus. It has been our observation that sequestra break away and separate earlier than with any other type of treatment we have used. The granulations of the wound appear flat, firm, smooth, bright and healthy. The pectin seems to discourage the excessive piling up of raised, anemic, superfluous granulation tissue. It has been our belief that these wounds heal much more rapidly than by any other form of treatment.

INFECTED COMPOUND FRACTURES: The same technique is applied in the treatment of infected compound fractures as is used in osteomyelitis. A wide-open wound, however, is absolutely essential for the successful application of pectin. Our clinical observations are similar to those of osteomyelitis.

INFECTED SOFT TISSUE WOUNDS: Again the wound must be wide open. The debris should be surgically removed. The technique of application is exactly similar to osteomyelitis, except that immobilization in a cast is not absolutely essential in many instances, but in the extensive wounds of the extremity a plaster splint or cast is advantageous, as the added factor of rest to the extremity bears a very definite relation to healing time. Our clinical observations are similar to those of osteomyelitis, except that soft tissue wounds heal much more rapidly.

Analysis

WHAT IS PECTIN?
Answers:

1. *Chemical Formula:* Arabino monogalacto diacetyl heptamethoxyl octogalacturonic acid. (With resulting split products of arabinose, galactose, methyl alcohol and galacturonic acid.)
2. *Universal* in plant life—Serving apparently as an intercellular mortice.
3. *Found in* abundance in apples, bananas, and most vegetables and fruits.

WHY DOES IT HAVE A FAVORABLE ACTION ON WOUNDS?

Answers:

Among the theories the following are involved:

1. The huge pectin molecule envelops or starves the bacteria.
2. It absorbs 20 times its weight.
3. Its viscosity.
4. Its acidity.
5. Its split products (galacturonic acid?).
6. It has natural defense mechanism.

WHAT KIND OF PECTIN IS USED?

Answer:

1. Flake pectin. (Sardik and General Foods are the types that we have used.)

WHAT STRENGTH OF PECTIN IS USED?

Answer:

1. A 2% solution in distilled water is easily applied. Higher percentages may be used but they are thick and difficult to apply.

How is Pectin Prepared for Use?

Answers:

1. Sufficient flake pectin is placed in distilled water to make a 2% solution.
2. Sealed and shaken occasionally; 24 hours is usually required to dissolve.
3. Autoclave for 15 minutes at 20 pounds.
4. Keep tightly sealed.

Is Pectin Bactericidal?

Answers:

1. Yes, it is bactericidal to many bacteria under favorable circumstances.
2. Its bactericidal effect varies *inversely* with the pathogenicity of the organism (Tompkins). Illustration: Strep killed easily. Staph resistant.
3. Its action is not diminished by autoclaving at 20 pounds for 15 minutes.
4. When improperly sealed it turns yellow and becomes ineffective.
5. Its bactericidal effect is lost with a pH above 5.5. Alkali breaks it down.
6. The pectins of different manufacturers vary with respect to bactericidal properties.

What Wounds are Effectively Treated with Pectin?

Answers:

1. Old infected burns.
2. Pressure sores.
3. Infected soft tissue wounds—*but* they must be wide open with free drainage. (Sinuses and pus pockets are difficult to treat.)
4. Osteomyelitis.
5. Infected compound fractures.

How is Pectin Solution Applied to Infected Burns?

Answer:

1. Every 24 hours dressings are gently removed.
2. Area rinsed with tepid water or saline.
3. Covered with three or four layers of gauze.
4. With a bulb syringe 2% pectin is *floated* into the gauze until completely saturated.
5. The gauze is covered with oil silk.
6. Every four, six or eight hours the dressings are remoistened.

Clinical Observations with Respect to Burns.

1. Sloughing areas will loosen, disappear, be washed away, or may be cut away in a few days.
2. The gauze does not stick or tear the granulations when removed.
3. The changing of dressings seldom causes discomfort.
4. The pungent, purulent discharge will disappear.
5. Firm, flat, level, healthy granulation tissue will rapidly develop.
6. Flat scar tissue will appear in islands and at the edges of the wound.
7. If skin graft is advisable usually one week or so of pectin dressing is adequate preparation.

How is Pectin Solution Used to Treat Osteomyelitis?

Answers:

1. Acute or chronic may be treated.
2. Adequate operative drainage and clean-up are required.
3. The wound is filled with dry gauze.
4. One or more small perforated rubber tubes is embedded in the gauze to the base of the wound.
5. The gauze is impregnated with 2% pectin solution.
6. A bias flannel compression bandage is applied.
7. Sheet wadding, felt and a plaster cast.
8. After 24 hours a generous window *exposes* the dressings. (They are not removed.)
9. Every 24 hours pectin solution is instilled through the tubes. Superficial dressings are saturated.
10. Fenestrated area covered.
11. After one week (usually) old dressing removed and wound redressed.
12. Further dressing will depend on progress of healing.

Clinical Observations with Respect to Osteomyelitis.

1. Pectin solution seems to have a local hemostatic effect.
2. Little pain or discomfort from changing dressings.
3. No putrid odor.
4. Becomes non-purulent.
5. Sequestra break away early.
6. Bright, healthy granulations (flat, firm, smooth).
7. Discourages excessive piled up, raised, anemic granulations.
8. Heals rapidly.

How is Pectin Used in Treatment of Compound Fractures?

Answers:

1. It is used only in infected fractures.
2. Its use requires wide-open, cleaned-up wound.
3. It is applied as in osteomyelitis.
4. The clinical observations are similar to osteomyelitis.

How is Pectin Used in Treatment of Infected Soft Tissue Wounds?

Answers:

1. The wound must be wide open and surgically cleaned up.
2. It is applied as in osteomyelitis, *except that:*
3. Immobilization in cast is not absolutely essential in many instances.
4. Clinical observations are smilar to osteomyelitis *except* that soft tissue wounds heal more rapidly.

How are Pressure Sores, etc., Treated with Pectin?

Answers:

1. These are treated exactly like burns.
2. They heal more rapidly and with less defect.

Deductions

WE BELIEVE that pectin solution is an excellent dressing, and that it materially diminishes the healing time of infected wounds as compared with other known methods.

2. It causes the patient little or no discomfort even when dressings are changed. (Dressings do not stick to wound.)

3. Immobilization in plaster casts promotes rest which favorably influences healing.

4. Instead of a foul, putrid odor, emitted under certain approved methods of treatment, pectinized wounds smell fresh and clean.

5. Instead of a profuse, purulent discharge so frequently seen, the pectinized wound is non-purulent and clean looking.

6. Instead of piled up, irregular, superfluous, anemic granulations, pectinized wounds have clean, healthy, flat granulations.

7. The epithelialized scar formation seems smoother and flatter when pectin has been used.

8. Pectin seems to have, or stimulate, a natural defense mechanism against the infection in wounds.

Discussion:

DR. JAMES A. JACKSON: I wanted to ask you the type of pectin you use? You spoke of a difference in commercial varieties.

DR. MIKKELSEN: If it is so highly bactericidal, why autoclave?

DR. THOMSON: I am familiar with only two products: One is that of the Sardik Food Products in New York, the flake pectin type; and the other is that put out by the General Foods Corporation. It has been our observation that both go into solution about the same. Dr. Arnold, of this city, has questioned whether the Sardik preparation is a true pectin or a pectinate. Nevertheless, it shows all the similar reactions as the General Foods' pectin except that it is apparently a little more bactericidal. But the General Foods' pectin seems to have the same influence on the stimulating of a good healing wound.

We have not gone far enough in our small series of 40 or 50 cases to say whether the one is really better than the other. It is true that Sardik will go into solution a little more easily than General Foods'. It is a little easier to get, however. They claim no medicinal value whatsoever, although we know that it has a value in certain gastro-intestinal conditions.

The question was asked: "Why autoclave?" Well, I wonder, sometimes. I have had the temerity to use it in the office much against my associate's better judgment without autoclaving. Letting it stand 24 hours, we have made cultures of bacteria and have not had any growth, or very little growth, and once in a while we will find something that will grow right up. But we have found that autoclaving at 20 pounds for 15 minutes doesn't interfere with its function and then we have taken every precaution we could. I always have a fear of introducing something into the wound.

We don't know where the pectin comes from, nor how. It is a flake material. Whether it might have some spores or something else in it we do not know, so we feel that it is a precaution we should take. We always autoclave under ordinary circumstances. We don't want anything to come under criticism because of poor technique.

The Technical Exhibits

— A Successful Beginning —

FOR the first time in its long history, the American Association of Industrial Physicians and Surgeons had scientific and commercial exhibits as a feature of its Annual Meeting. The beginning in this respect was an unqualified success. The exhibitors contributed greatly to the interest and importance of the meetings, and many of them learned, first hand, so much they had never before appreciated about the field of *industrial* medicine and surgery, as to make them desirous not only of exhibiting again, but also of developing a means of closer contact with this field throughout the months until next meeting time. Following is a summary as to the "technical" exhibits:

BROOKS APPLIANCE COMPANY

BROOKS APPLIANCE COMPANY, 5 North Wabash Avenue, Chicago, exhibited a variety of items for ambulatory treatment. Their first aid bandages and dressings are different, owing to the fact that they have a stretchy adhesive made in single dressing strips, or in one-yard and 10-yard lengths, with the medication in the center, which serves regardless of the length of the wound and permits a dressing without using many small strips. For varicose veins and varicose ulcers they have a Tensoplast bandage which has been adapted and used by many of the leading universities and clinics.

For those who cannot—or will not—have their hernia repaired, they have a truss which has been proved by use in many of the larger companies as most efficient, easiest for the wearer, and most adaptable for men who are active in industry. "If a ruptured man can be supported with a proper fitting truss which will not slip out of place regardless of the type of work he is doing, he will be a better man. . . . But the only satisfactory way for the surgeon to have a complete and thorough idea of our truss is to have a sample sent out for his inspection, which we are offering at this time." The new catalogue covering the Brooks Appliances, of their various kinds, will be available shortly, to follow up the displays, and the contacts, made at the Convention.

CAMERON SURGICAL SPECIALTY

CAMERON SURGICAL SPECIALTY COMPANY, of Chicago, displayed the new LEMPERT-LEMEE HEADLITE, and the latest developments in electrically lighted diagnostic and operating instruments for all parts of the body. Of special interest were the new inexpensive office model of a radio knife and other electro-surgical units for cutting, coagulating, desiccation and fulguration, ranging in size up to the 'Hospital Model" which has sufficient power for the most radical and heavy surgery. The CAMERON HEARTOMETER, an outstanding achievement in cardiac diagnosis, was also shown.

J. J. DRISCOLL, EDW. L. HILL, and R. S. WURSHIP were the company's representatives.

C. B. FLEET

C. B. FLEET COMPANY, Inc., Manufacturing Chemists, of Lynchburg, Virginia, displayed PHOSPHO-SODA (Fleet), an ethical, concentrated preparation of the sodium phosphates buffered and in a stable solution. Phospho-Soda is a reliable intestinal eliminant and detoxifying agent, acting quickly without griping or causing tenesmus. Phospho-Soda (FLEET) has, for 50 years, been recognized by the medical profession as being the desirable choleretic and cholekinetic. The ease of administration and flexibility of dosage give Phospho-Soda a wide range of usages.

Attractive measuring glasses and samples of Phospho-Soda were supplied at the Fleet booth.

WM. S. HOLT, J. GORDON MYERS, and A. R. SHELLY were the company's representatives.

DENVER CHEMICAL

DENVER CHEMICAL MFG. CO., 163 Varick Street, New York City, exhibited their well-known Antiphlogistine and their less well-known Galetest.

DR. C. A. WASHBURN, who was in charge of the exhibit, reported much interest on the part of the delegates in Galatest, which is just being introduced to the medical profession. It consists of a compound, in powder form, for the instantaneous detection of sugar in urine, but, unlike other methods of making urinalyses, it requires no elaborate technique or laboratory equipment. With the aid of a medicine dropper one drop of the urine to be tested is allowed to fall onto a little of the Galatest powder which has been deposited on a piece of paper. If sugar is present an instantaneous reaction takes place, which will accurately reveal varying degrees of sugar ranging from 0.1% to 1% and over.

It is anticipated that industrial physicians and surgeons will find it as invaluable for making routine "check-ups" of those coming under their supervision, as are many insurance companies, hospitals and physicians in private practice who are now making regular use of it.

DEQUIN PHYSICIANS PRODUCTS

DEQUIN PHYSICIANS PRODUCTS, of Chicago, manufacturers and distributors of pharmaceuticals of high therapeutic value, displayed ALPARENE for the injection treatment of hernia and hydrocele; a product of painstaking animal research and clinical trial—of suspensoid, character, non-toxic, painless, and producing the mature, dense fibroplastic repair tissue so sought for in the ambulant treatment of hernia.

DEPUY MANUFACTURING

DEPUY MANUFACTURING COMPANY, of Warsaw, Indiana, Booth 78, had a display of the latest appliances for treating fractures. Mr. W. D. Bates, who was in charge, gave useful suggestions on the use of the various appliances. The DePuy Reducing Frame for lower leg fractures created a great deal of interest. This frame is of great value in reducing difficult leg fractures. Another item of interest was the display of Vitallium. This line is new on the market, and DePuy Manufacturing Company has found that fracture surgeons are much interested in it. Vitallium is a very hard, non-corrosive metal used in the manufacture of bone plates, bone screws, etc. This metal has perfect tissue tolerance, is immune to body fluids, and compatible with tissue, and it contributes to normal bone growth. The DePuy Rocking Leg Splint, while not a new item, is still very popular in fracture reduction. A new extension finger splint was displayed, also a new Blind Finder to be used in locating the position for Smith-Petersen nails. Of course, a standard line of splints for Colles', cervical, Pott's and many other fractures was shown.

DOMORE CHAIR

DOMORE CHAIR COMPANY, Inc., of Elkhart, Indiana, exhibited its latest developments in executive, clerical and factory seating, showing the Do/More "Masterpiece" executive chair for the senior executive, the "Woodfield" executive chair, the Do/More "Air-Duct" ventilated chair, and also the factory chair. The many industrial physicians and surgeons visiting the booth expressed very definite interest in this type of seating.

On a selection of registered numbers, DR. DAVID C. STRAUS, Director of Hygiene Division, State of Illinois, was awarded a Do/More "Woodfield."

EICHENLAUBS

EICHENLAUBS, manufacturers of Hospital and Institutional Furniture, 3501-3 Butter Street, Pittsburgh, Pennsylvania, had on display one of their Wood Private Room Groups, which they manufacture for hospitals featuring the Deluxe Private Room service.

The hospital bed was somewhat sensational inasmuch as it featured the new Cartiac and Post-Operative spring. The advantages of this spring over the ordinary old type gatch spring are numerous; a few of the important points are: that all the operations can be handled by one person, namely, the nurse in attendance, and she need not solicit any assistance in handling a patient, because with this spring she can place the patient in the Trendellenburg or the Fowler position with a mere few twists of the wrist. It is also possible to sit the patient up in bed in an easy-chair position without so much as touching the patient or disturbing his comfort. This new spring, of course, is extremely valuable in post-operative cases and where patients have to be handled with especial care; the adjustments of the various positions are made with exact precision and no trouble. This equipment is new on the market, and the physicians and surgeons who saw the display showed deep interest in it.

FAIRWAY LABORATORIES

FAIRWAY LABORATORIES, Inc., of Belleville, Illinois, well known to industrial physicians for the authoritative information they have furnished, over the past 10 years, on prevention of heat sickness, were present with an attractive display of all their salt tablet services.

C. M. SCHOFIELD, President, was in charge, and he showed the new improved molded plastic dispensers in both the Junior size of 1,500 tablet capacity, and the new

Midget Dispenser of 350 tablet capacity. This new small unit has met with immediate acceptance as furnishing dispenser service for small groups.

The new "Shake-Out" Group package for dispensing tablets through the water boy or supervisor attracted the attention of physicians connected with railways and utilities.

The Combination Dextrose and Sodium Chloride Tablets were also sampled and explained.

A new booklet, "Are Your Workers Worth Their Salt," was given to each inquirer.

GENERAL ELECTRIC X-RAY

GENERAL ELECTRIC X-RAY CORPORATION, 2012 Jackson Boulevard, Chicago, exhibited the new lightweight, low-cost Electrocardiograph and accessories; the G-E Inductotherm with surgical attachments for combined surgical diathermy and heat treatment ranging from local application to fever therapy by electromagnetic induction; and a display of radiographs illustrating the type of radiographic work possible with various types of G-E x-ray equipment.

In attendance were H. I. NELSON, manager of the Detroit Branch; and CHARLES MINNICH, Technical Service Department, S. F. CULVER, A. O. OSTERLING, and G. E. SIMONS, Manager Sales Promotion Department, Chicago.

HOLLAND-RANTOS

HOLLAND-RANTOS COMPANY exhibited its complete line of specialties: the Koromex diaphragm and Koromex vaginal jelly; the new H-R Emulsion Jelly; the Koromex diaphragm introducer and Kahma Powder method of contraception; two surgical silk fabrics — Rantosilk and Hollandex — used extensively in hospitals for bedding and also made up into garments, such as surgeons' aprons, patients' throws, etc.; the Rantos Fever Bag, designed for use as an accessory to various types of fever inducing apparatus, its primary function being that of a heat retainer; and the Powdex Vaginal Insufflator, with the various cinquarsen and stovarsol formulae, used for the dry treatment of trichomonas vaginitis.

KAREL FIRST AID SUPPLY

LOUIS K. KAREL, H. H. BUSBY, and JEROME HLINKA represented the Karel First Aid Supply Company, 2450 S. Kedzie Avenue, Chicago, in an attractive exhibit of first aid supplies and equipment of every kind required in industrial medical work.

HORLICK'S MALTED MILK

HORLICK'S MALTED MILK CORPORATION, of Racine, Wisconsin, exhibited HORLICK'S, the Original Malted Milk, Powder and Tablet forms, and distributed samples of the Tablets, as well as literature. Among the special uses of HORLICK'S MALTED MILK which were featured are its advantages as an easily digested, nourishing food-drink, notably in nervous and digestive disorders, in gastric and duodenal ulcers, and wherever a food of ready assimilability is indicated. The Tablets offer a practical solution to the problem of between-meal feedings for ambulatory ulcer patients, as well as a convenient source of quickly available food-energy for the general factory and office worker.

P. E. GUNTON, E. J. ROHAN and J. M. CLEARY were in attendance at the exhibit.

KEYSTONE VIEW COMPANY

KEYSTONE VIEW COMPANY, of Meadville, Pennsylvania, had an exhibit which featured the Visual Safety Tests given through the Telebinocular. The Telebinocular is a precision-made stereoscope built purposely for separating groups of individuals into two classes—those likely and those not likely to profit from a complete eye examination. Each Doctor visiting the booth was given the Keystone Visual Safety Test and a record of the findings.

The Doctor's importance in the industrial plant can be emphasized measurably by the Keystone Visual Safety Tests. They permit him to cooperate more closely with the Safety Department who may wish only the best qualified individuals to operate trucks, cars, cranes, or other instruments where quick and accurate perception of speed, location and distance are factors in safety. Also he can cooperate more effectively with the industrial engineer, who wishes only the most skilled individuals both manually and visually in the departments of inspection, assembly, etc.

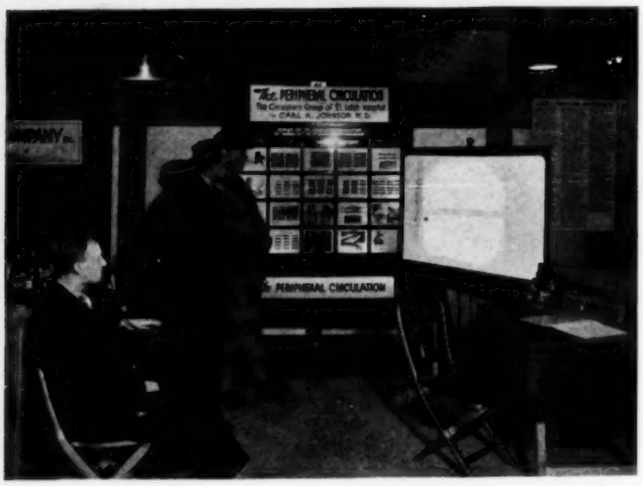
LaMOTTE CHEMICAL PRODUCTS

LAMOTTE CHEMICAL PRODUCTS COMPANY, McCormick Building, Baltimore, Maryland, exhibited a complete series of their simplified blood and urine testing units. The display was in charge of W. R. KENNY, Research Chemist for the company's Baltimore laboratories, and complete information was given to those in attendance, concerning the operation of these new and approved outfits.

Of particular importance was the display of the LAMOTTE apparatus and antigen for determining the presence or absence of syphilis, by the Kline slide test. These compact units are finding a wide range of usefulness in clinical work.

Other interesting apparatus shown for routine use by the physician were the LAMOTTE sets for determining sulfanilamide in blood and urine, sugar in blood and urine, urea in blood and saliva, calcium-phosphorus in blood serum, pH of urine and feces, and bromides in blood, as a means of detecting bromide intoxication.

Other similar units were of interest to those specializing in the various steps in clinical medicine.



A descriptive booklet giving information on all of the above items is available, upon request.

LIPPINCOTT

J. B. LIPPINCOTT COMPANY of Philadelphia, Pennsylvania, had, in charge of J. W. COLEN, an extensive display of new and standard medical books among which were: BACON—Anus, Rectum and Sigmoid Colon; THOREK—Modern Surgical Technic; KRACKE—Diseases of the Blood and Atlas of Hematology; WILSON—Fractures; WOLF—Physician's Business . . . and New Editions of old favorites; McBRIDE—Disability Evaluation; REHBERGER—Quick Reference Book of Medicine and Surgery; THOREK—Surgical Errors and Safeguards; and MEANS—Thyroid and Its Diseases, as well as the NEW International Clinics edited by DR. GEORGE MORRIS PIERSOL.

A new Lippincott book, just published, which attracted much attention was: "Youth at the Wheel."

MINE SAFETY APPLIANCES

MINE SAFETY APPLIANCES COMPANY, of Pittsburgh, Pennsylvania, displayed a complete line of safety equipment for the protection of workers in all industries.

Of special interest was the new Dustfoe Respirator, approved by the U. S. Bureau of Mines, which provides full protection under the most severe dust conditions. Several types of M.S.A. Comfo Respirators were displayed. These respirators give full protection against nuisance and lead dusts, paint spray fumes, and light concentrations of organic vapors.

The M.S.A. instrument line, including gas-detecting, analyzing, and recording instruments, and dust-counting instruments, also drew much attention. The newest development of the M.S.A. research laboratories in this group is the Explosimeter, a pocket-size instrument for detecting the presence of combustible gases.

Other M.S.A. products on display included Bakelite Salt Tablet Dispensers; Goggles, All-Weather First Aid Kits; Skullgard Protective Hats and Caps; M.S.A. Abrasive Masks and Air Line Respirators; and Resuscitation Apparatus, the H-H Inhalator.

The M.S.A. representatives in attendance were: A. B. DAVIS, N. W. HARTZ, GEORGE KNOLL, C. H. MEHAFFEY, and C. C. O'DONNELL.

MORTON SALT

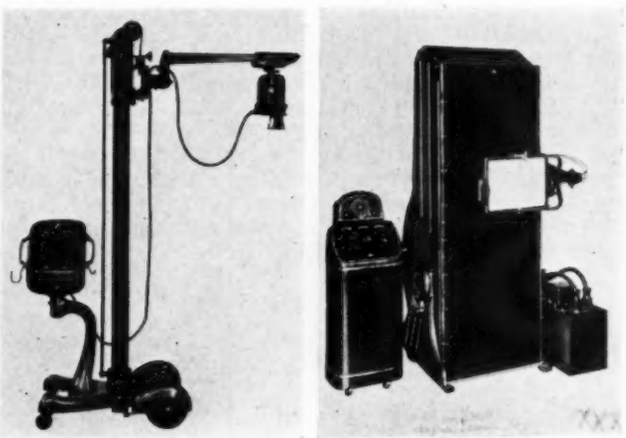
MORTON SALT COMPANY, 208 W. Washington Street, Chicago, displayed, for the first time at any Convention, its Salt Tablets for heat relief. The items shown were the 10-grain Salt Tablets and the 10-grain Salt-Dextrose Tablets, which are 50% salt and 50% dextrose, also the dispenser, which is made for supplying factories and industrial plants with a convenient way of dispensing the Tablets to their workers.

PHILIP MORRIS

PHILIP MORRIS & COMPANY, LTD., Inc., demonstrated the method by which it was found that PHILIP MORRIS cigarettes, in which diethylene glycol is used exclusively as the hygroscopic agent, are considerably less irritating than ordinary cigarettes. This was shown by the use of a smoking machine and by charts of the animal experiments and clinical tests on this subject. A. W. LAWTON and MISS E. G. SIRLIN, R. N., were in attendance to explain the exhibits and answer all questions on the processing of tobacco. Guest packages of PHILLIP MORRIS cigarettes were given to the attending physicians.

PICKER X-RAY

PICKER X-RAY CORPORATION had on display several of the well known models of Shockproof Radiographic and Fluoroscopic Equipment. Of particular interest was the "Series 200" Unit consisting of Motor Driven Radiographic and Fluoroscopic Tilting Tables with Bucky Diaphragm, Spot Film Device and Shockproof Tubes. The Transformer which is of the four valve fully rectified type is shockproof, thereby, making the whole Unit self-contained and without any exposed high tension parts. Two other shockproof units were shown, one a Mobile Bedside Unit with oil-immersed Transformer and Tube and Lead-lined Cassette Box mounted on the Mobile Base, and the other a portable X-Ray Machine, also shockproof and with oil-immersed Transformer and Tube.



The picture at the left shows the Shockproof Mobile Bedside X-Ray Unit; that at the right, the Shockproof 200 M.A. Transformer, Tilting Table, Control and Timer, Radiographic and Fluoroscopic.

S.M.A. CORPORATION

S.M.A. CORPORATION, Cleveland, Ohio, presented several nutritional and vitamin specialties of specific interest to industrial medicine. The exhibit comprised poster material and trade packages of the products shown.

The poster material displayed factual data and references regarding the application of SMAco Carotene-in-Oil in the treatment of night blindness, and an announcement concerning SMAco Nicotinic Acid, together with references to the use of nicotinic acid in the treatment of pellagra.

The products shown included:

SMAco Carotene-in-Oil (Capsules and Liquid).

SMAco Carotene-with-Vitamin-D-Concentrate-in-Oil (Capsules and Liquid).

SMAco Nicotinic Acid (Tablets and Ampoules).

S.M.A.—the Antirachitic and Antispasmophilic Breast Milk Adaptation.

Protein S.M.A. (Acidulated)—A special food for undernourished newly born infants, premature infants, infant diarrhea of nutritional origin, other infants needing a high protein intake.

Hypo-Allergic Milk—for infants and adults sensitive to milk protein.

Alerdex—The Protein Free Maltose and Dextrins—A white free-flowing, non-hygroscopic maltose and dextrins free from traces of cereal protein. Recommended for modifying Hypo-Allergic milk for infant feeding. A valuable carbohydrate milk modifier for routine use.

SMAco Carotene-in-Oil (carotene is Pro-Vitamin A) permits the administration of vitamin A activity alone uncomplicated by the presence of other vitamins. It is of particular interest in industrial medicine in this connection for its use in increasing reserves of vitamin A in cases of night blindness resulting from vitamin A deficiency. The effect of strong illumination upon visual purple, vitamin A and impaired visual threshold in connection with color inspection in industrial production was discussed in a recent article (Report of the Use of the Bio-photometer and Vitamin A Therapy in Industry," RALPH C. WISE, M.D., and O. H. SCHETTLER, M.D., Mansfield, Ohio, in *Ohio State Medical Journal*, 34:666, June, 1938).

The S.M.A. Corporation Exhibit was in charge of H. L. HALL, Chicago representative of the company.

SUTLIFF & CASE

SUTLIFF & CASE CO., Inc., 200 Voris Street, Peoria, Illinois, was represented by J. F. STONISH, Sales Manager, and W. B. BAKER, Laboratories Director.

The physician who is served by SUTLIFF & CASE finds more than 1000 medicinal products from which to choose. A representative selection from these was exhibited at the Convention. In this large group there are specialties, capsules, elixirs, effervescent salts, fluidextracts, glycerites, liniments, microscopic and biological staining solutions, mixtures, ointments, powders, solutions, spirits, suppositories, syrups, tablets (molded, compressed triturates), test solutions, reagents, indicators, tinctures, vaginal cones. And in addition to specialties and standard preparations, a complete line of physicians' supplies and sundries is handled by this company for the convenience of physician accounts.

SUTLIFF & CASE possess an enviable record of service to, and cooperation with, the medical profession; this record has been built on a solid foundation of more than a half century of *progress with the profession*. Their Convention leaders were THIO-CARA and THIOCYAN-TABS, pharmaceutical preparations for judicious thiocyanate therapy in the treatment of arterial hypertension.

THIO-CARA is an aromatic liquid preparation containing a therapeutic dose of potassium thiocyanate; it also contains aromaticized cascara to induce elimination—so often essential in treating arterial hypertension. It contains no sugar, thus providing a factor of safety in the management of hypertension in diabetics.

THIOCYAN-TABS are tablets compounded with the calcium derivative of the thiocyanate, and are specially coated so that disintegration of the tablets is delayed until they reach the intestinal tract. The tablets may be used interchangeably with THIO-CARA, especially where mild laxative action is not deemed necessary.

These worthy thiocyanate preparations have been supplied to the medical profession over a period of many years, with gratifying results reported and with an ever-increasing repeat demand for their use.

WESTINGHOUSE X-RAY

WESTINGHOUSE X-RAY CO., Inc., of Long Island City, New York, displayed its new Autograph X-Ray Film device, whereby the patient signs his name on the sensitized surface of his film in ordinary daylight. This device—simple, new, ingenious, fool-proof, "litigation-proof," and patented—provides the long-term identification of individual x-ray films which is such an essential element of employee surveys.

There was also the WESTINGHOUSE portable condenser discharge x-ray machine which makes it possible to take high-energy x-ray plates with current from an ordinary light socket.

This interesting exhibit was in charge of M. B. EVANS, District Manager, Detroit, and AL. W. KOCH, District Manager, Chicago.

ULMER PHARMACAL COMPANY

ULMER PHARMACAL COMPANY and PHYSICIANS & HOSPITALS SUPPLY COMPANY maintained a very interesting booth in charge of KENNETH B. SCHOTTLER and RALPH J. TAYLOR at which at chief attraction was a motion picture film describing the technique, advantages, and contra-indications of the injection treatment of hernia. This 16 mm. film was prepared by Dr. L. E. Hanisch of Omaha, Nebraska, for presentation to the Western Surgical Society in Omaha and is not in any sense a commercial film. It is, therefore, particularly interesting to the routine practitioner who meets with this problem. The film is available to any surgeon or medical group who wish to borrow it for individual or group study. Application should be made to ULMER PHARMACAL COMPANY, 412 South Sixth Street, Minneapolis, Minnesota.

The booth included presentation of the product, PROLIFEROL, for the injection treatment of hernia. Proliferol "T" is the solution of choice used by the Hernia Injection Clinic of the University of Minnesota and also the Hernia Injection Clinic of the Northwestern University School of Medicine.

The Phyco Clinical leather covered truss for everyday use and the Phyco Clinical Bath Truss for use in the bath, shower, and for swimming were items which attracted much interest. These appliances especially designed for use in conjunction with the injection treatment of hernia are being received by physicians and surgeons throughout the entire world with a great deal of appreciation and satisfaction. Since the Phyco Clinical Trusses positively retain the hernia irrespective of what position the patient may assume, they are the recommended appliances for hernia whether or not the injection treatment is to be given.

Other interesting exhibits at this booth included display of the product, Calzo, for the ambulatory pressure sponge method in treating varicose ulcers; solution of sodium morrhuate and solution of invert sugar with sodium chloride for sclerosing varicose veins; and the specialized coal tar ointment, Co-Tar-Ox, for treatment of eczematous conditions; the ointment, Picro-Benzyl, for routine treatment of burns; Colvinol, a cod liver oil compound ointment; and Allantoin compound ointment.

A particular item of interest in this display was the product, Biliposol, a basic, organic complex, which is very rich in metallic bismuth, in a form very well received by the human body and quickly converting itself into the usable form of bismuth within the body and without toxic manifestation. Biliposol is supplied in a clear oil solution, for intra-muscular injection, permitting of accurate dose of bismuth, which is completely absorbed within a period of two weeks, yet is eliminated so slowly that bismuth is demonstrable in the excretion of the body for six or eight weeks after the last injection. It is an

admirable product to use in connection with arsenical treatment of syphilis, and has been used in France for treatment of syphilis without association of arsenical medications.

The PHYSICIANS & HOSPITALS SUPPLY COMPANY'S display of high quality imported surgical instruments was particularly worthy of notice. These instruments are perfect in construction, beautifully chrome plated, and polished with such precision as to assure long and satisfactory service. The prices are considerably lower than is usual for instruments of the high quality described. This display also included a complete set of National body cavity diagnostic instruments. It is perhaps the most complete set of such electric lighted diagnostic instruments for visualization of the body cavities which is available on the market.

ZIMMER

ZIMMER MANUFACTURING COMPANY, of Warsaw, Indiana, exhibited a very complete line of fracture equipment, which attracted much attention. There was particular interest in the Smith-Petersen outfit and the Kirschner outfit, instruments used quite extensively at the present time in bone work.

The exhibit was in charge of F. C. BARTOL and A. P. RAMSAY.

WILLSON PRODUCTS

THE WILLSON exhibit (WILLSON PRODUCTS, INC., Reading, Pennsylvania) included devices which may be classified in two distinct groups: first, apparatus such as the Impinger, Dust Counter, Chlorinated Hydrocarbon Apparatus, and the Thermo-Anemometer used in the determination or evaluation of the degree of the workers' exposure to atmospheric contamination; and, second, respirators of various kinds worn by workers to decrease or eliminate objectionable contaminants from the inspired air.

The impinger dust sampling outfit is of the Greenburg-Smith[1] type with modifications according to Hatch[2]. The outfit consists of three units, two of which are necessary for operation. Unit No. 1 is a carrying case containing the impinger flasks and nozzles. Unit No. 2 is a compressed air operated ejector designed to draw air through the sampling flasks at the standard rate of one cubic foot per minute. This unit is suitable only in places where compressed air between 30 and 75 pounds per square inch is available. Unit No. 3, consisting of a pump driven by an electric motor, is calibrated to draw air through the sampling flask at a rate of one cubic foot per minute. The motor is operable on 110 or 220 volts, AC or DC current. This unit meets the requirements of the U. S. Public Health Service.

The dust counter is of the Owens Jet type with recent changes according to Bausch & Lomb in collaboration with the engineers of a large insurance company. Twelve dust samples may be collected on a glass disc contained in the instrument. The collected samples may be quantitated by means of a microscope which is an integral part of the counter. Dark field illumination and a magnification of 200 times are employed. This instrument is a routine sampling device intended to serve industry wherever rapid routine check-ups are necessary.

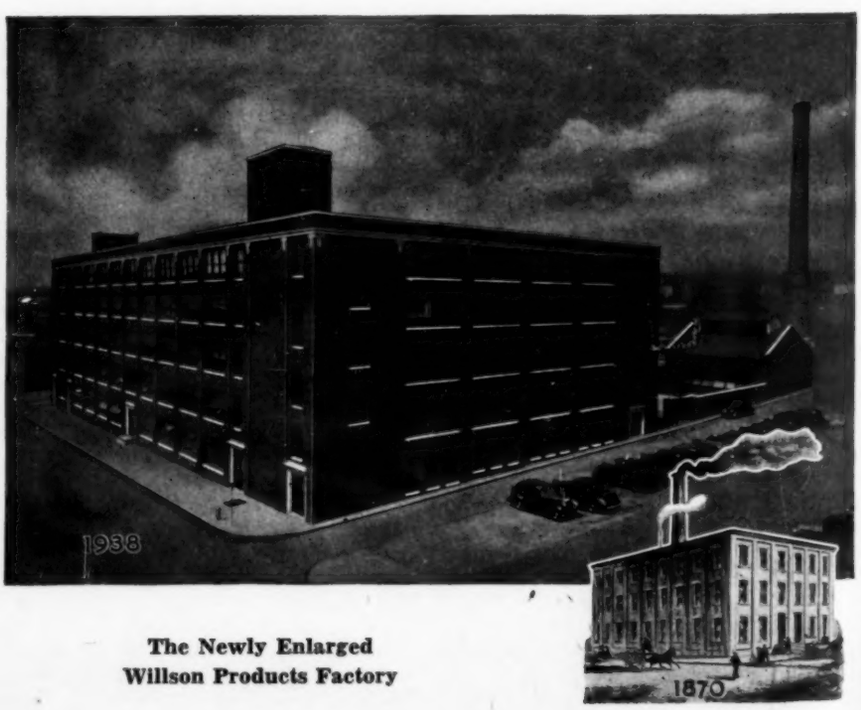
The Chlorinated Hydrocarbon Apparatus consists of two primary and two accessory units. The primary units are the combustion analyzer and the suction pump; the accessory units are a tripod for holding the combustion analyzer at a convenient sampling height, and a mailing case with eight glass-stoppered bottles for mailing field samples to the laboratory for analysis. The Combustion Analyzer is a sampling unit similar in design to that employed by Hemperly[3]. The principle of operation is similar to that described by Tebbins[4]. The suction pump is similar to the No. 3 impinger unit described previously, except that it is not calibrated for a given flow. The flow meter is part of the combustion analyzer.

The Willson Thermo-Anemometer is a device developed by Yaglou[5] for measuring accurately the rate of air movement over a wide range. It is a small compact unit, and is independent of an external source of energy for operation. Its operating range is 0 to about 6000 feet per minute and in this range the accuracy is within about 2%. While the instrument is not of the direct reading type, its operation is very simple.

A complete line of respirators, including a supplied-air welding helmet, was shown. Supplied-air respirators, chemical cartridge respirators and a large line of Bureau of Mines Approved mechanical filter respirators completed the Willson exhibit.

The convention was attended by the following representatives of Willson Products, Inc.: DONALD CHARLTON, J. F. CLARK, ROY ABELL, GEORGE SEMPLE and DR. A. D. BRANDT.

Below is an illustration of the growth of the Willson Products factory—recently enlarged to meet the rapidly mounting production demands. The new building has 110,000 square feet of operating floor space, and is modern in all respects of construction and arrangement. The factory normally employs about 500 people.



The Newly Enlarged Willson Products Factory

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Skin Affections in Industry

—With Special Reference to the Value of the Patch Test—

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INDUSTRIAL dermatoses constitute, roughly, about 60% of industrial diseases, not including actual accidents.* This was a resumé of industrial dermatoses in 1933 and 1934 by the United States Public Health Service. In England, in 1927, skin disease comprised about 72% of the industrial disease total, and in 1934 Prosser White estimated occupational dermatoses to be 15 to 20% of all skin diseases.

Sulzberger thinks these figures are all below the actual incidence and gives several pertinent reasons; he feels it is no exaggeration to state that such occupational skin diseases are second only to occupational accidents. Sulzberger also feels that over half of the cases of occupational dermatoses are due to sensitivity.

Foerster says the majority of industrial dermatoses in this country are cases of contact dermatitis, and are due to acids, alkalies, caustics, oils, greases, and solvents. Schwartz, in 1935, found that occupational dermatoses in New York were largely due to alkalies and petroleum derivatives; in Missouri they were due to lime, cement, and plant poisons; in Connecticut more were due to plant poisoning and to mercury used in the hat industry; in Ohio the majority occurred in the rubber industry and in workers with oils and cutting compounds.

While the large percentage of occupational dermatoses are due to external irritants, whether the irritant be mechanical, vegetable, chemical or infectious (as bacteria and fungi), it can be seen at once that the diagnostic acumen must be alert to determine whether the dermatoses presented are clinically typical of a contactant or belong in some other syndrome. A contactant dermatitis is usually eczematous. As stated in a presentation before this organization two years ago, the most common differential etiological factor to be ruled out is whether there has been a pre-existing fungus infection of the parts afflicted or other intertriginous areas of the body, which may have produced a lowered resistance of the area where the dermatitis is present. The manifestations of superficial fungus infections and their sequelae have been fully discussed previously before this Society. A large percentage of persons with industrial dermatoses have active ringworm infections. Allergic states have to be ruled out in many of these eczematous patients.

More and more non-eczematoid lesions are being observed in occupational syndromes, a specific example being the production of acneform eruptions by oils and certain types of insulation. A differential diagnosis in a broad way brings into play practically the whole domain of dermatological diseases. Within the past year there have been observed cases of ringworm, herpes, tertiary syphilis, malignancy of the skin, varicella, lichen planus, and acute psoriasis from which occupational compensation has been sought. In general, then, there are two dermatological groups into which occupational skin cases can be divided: (1) Eruptions sufficiently characteristic as to point to their nature and etiology as chronic ulcers, oil acne, etc.; (2) eczematous eruptions which may or may not have been caused by some external agent with which the patient has come in contact during work.

The difficulties encountered in detecting the etiologic agent or agents are manifold, and at times extremely perplexing. During the past 10 years the so-called patch test has been used more and more in an effort to make an absolute decision as to the causative factors. Of course, the aim of the patch test is an effort to reproduce the dermatitis in miniature. As the patch test is the one most important aid in a diagnosis of occupational dermatosis, its proper evaluation is most essential. The literature in the last 10 years abounds with references to the patch test; for example, there have been 52 papers in the American literature, 29 in the French, 12 in the German, 11 in British, and on through the various nationalities to one in Russian. One hundred and four papers have been reviewed in an effort to obtain a composite picture of the scientific value of the use of the patch test in diagnosing contactant dermatoses.

Forty-three years have passed since Jadassohn brought out the principle of the patch test and applied it in extensive experimentation in German industrial medicine, but in the United States its uses have been important among medical criteria for about 10 years. The industrial problem or complications leading to such a test had to gain momentum and come to professional attention before its use became significant. Eleven states of the Union now compensate for injuries from contact dermatitis, and more states will probably fall into line. Its first use in the United States was by A. J. Markley, of Denver, who reported it in the first volume of the *Archives of Dermatology*, December, 1928. While a very valuable and interesting report, it was so modest that it escaped professional attention for years. His opening paragraph in this article states that the cutaneous phenomena which occur as a result of the absorption of foreign proteins through the respiratory tract and possibly through the skin itself have not received the attention and study that they deserve. He then gives a case report which illuminates the value of a patch test of a very puzzling widespread eczematous eruption. However, Markley's contribution was not followed by other workers until Sulzberger and Wise in 1931 brought out their illuminating paper on the

* Presented before the Nineteenth Annual Meeting of the Central States Society of Industrial Medicine and Surgery, Springfield, Illinois, May 17, 1938.

valuation of the patch test, which they had been routinely using for several years. Sulzberger and Wise gave Markley credit for doing this work in America, and Pasteur Vallery-Radot, in his book in 1930 on "Specific Hypersensitivity," gives Markley more credit. Markley's observation that his case of dermatitis had come from contact with guinea pig made a very profound impression upon this French writer.

In the evaluation of the patch test J. T. Ingram, writing on dye dermatitis in the *British Journal of Dermatology,* states that the test has now become routine in dermatological investigation of allergic dermatoses and indicates specific epidermal sensitization. He feels that a positive reaction is the development of an eczematous reaction, sometimes erythematous but usually vesicular, exactly corresponding to the site of the application. He suggested that a positive or negative skin reaction may be shown by the skin of one portion of the body but not by the others. In the main, however, this seems to be an unlikely experience, since the skin being one organ one naturally assumes that it behaves as a whole and no satisfactory evidence has been found to support this viewpoint. In Ingram's experience in his fur investigations a positive reaction to a patch test may not develop until several hours or even days after the patch test has been removed. Whatever the meaning of such a delayed reaction might be, it suggested that an investigation conducted along these lines must keep the subject under observation for at least a month. This latter viewpoint is not shared by very many dermatologists as they feel the test should be positive within 48 hours if it is to have any scientific meaning.

G. H. Percival, writing in *The Lancet* of 1931, relates his experience in dermatitis provoked by furs. There were 15 subjects who were irritated by two furs as against 50 cases not suffering from fur dermatitis, all in the same establishment. He concluded that hair dye and fur dyes are in the nature of an allergic skin reaction and not the result of chemical or pharmaceutical irritation. Roxburgh had the same idea in 1924 from studying 86 cases of fur dermatitis.

Sezary, in discussing the pathogenic significance of the reactions to cutaneous tests of hypersensitivity in 1935, believes that the test to be positive is always vesicular or vesicular-edematous. He believes that the tissue hypersensitivity depends as much on the nature of the antigen as on the reactivity which is personal to every subject. He brings out the observation that the hereditary or familial element is generally absent in the epidermal sensitivity where the patch test is most applicable as compared to the mesodermal sensitivity in which the scratch or intradermal tests are of decided value. The reaction to a patch test, then, is relatively delayed as compared to the reactions in which the corium or mesoderm is primarily concerned, as the noxious substance enters the vascular system directly.

E. J. Trow discusses both the value of the patch test and the clinical test. He cites the factors which cause false positives, as hyper-irritability of the skin at the time of the test. Generally speaking then, he feels that considerable experience is needed in order to read and interpret the reactions, hence a positive test does not necessarily convict a suspect substance any more than a negative one rules it out. He gives extensive tables which he compiled giving dilutions of most test substances irritating a normal skin. Therefore, the dilution should be made below that point. He states that infrequently patch tests are confused with scratch or intradermal tests which in industrial dermatoses mean nothing, for such cases are conceded to be skin reactions confined entirely to the epidermis. He states further that while the patch test is our best means of control other factors, like heat, cold, friction, etc., also have a part in producing an eczematous eruption, and such factors are difficult to reproduce in our tests. Although the original dermatitis may involve one part of the body, tested areas far removed from that part may not react positively but he agrees with Sulzberger and Wise that the contact or patch test has proved indispensable in occupational dermatoses. He goes on further to discuss the clinical test. This clinical trial removes the patient from contact with the suspected substance to see if the eruption regresses. This test, too, is of doubtful value because eczematous eruption once produced generates local toxins capable of exciting distant eczematids as well as maintaining local inflammation for longer or shorter periods.

THE value of numerous patch tests is further enhanced at times revealing other existing syndromes. Even though inconclusive as regards the irritant substance, often revealed by many positive reactions, a subject is found to be suffering from a true allergic eczema. A person easily sensitized having inherited allergies is one to exclude from unsuitable occupations. However, the workman exposed to irritants during his working hours is naturally exposed to home irritants, such as soap, cleansing solutions, hair lotions, creams, dyes, hand lotions, patent remedies, etc. In the conclusion of his article he advocates a wider and wider application for the use of the patch test.

Along the thought of the danger of the allergic patient being more apt to be sensitive to various contactants, W. G. Harvey, writing in the *British Medical Journal* of 1933, brings out some interesting problems in regards to occupational dermatoses. He feels that in the treatment of occupational dermatoses as a prophylactic measure, workers with vulnerable skins should be excluded from industry. He specifically mentions the people with seborrheic, hyperidriotic, and xerodermatous skins, and those with deficiency circulatory systems. Likewise the employers should reduce to a minimum all noxious substances, and maintain proper cleansing agents for the workers' skins. Naturally the worker should be removed from a job where the materials irritate his skin.

In the discussion of industrial dermatoses, Wise

and Sulzberger feel that the patch test plays the most important part in the diagnosis of industrial dermatitis because it can determine whether the cause of the eruption is a substance connected with the patient's occupation. As a diagnostic measure, then, it is without an equal. As an aid in therapy it demonstrates which substance or substances must be avoided by the patient. For industry, it has great prophylactic value because it weeds out workers who are prone to eczematous sensitizations from industries which are forced to employ eczematogenous products, and it assists industries to eliminate such products if not absolutely essential or for which substitutes may be found. In my own experience I have found the patch test to be of indispensable value, as did Wise and Sulzberger. Other writers who have found it to be of great value when properly used and interpreted are Layman, writing in the *Journal-Lancet* of 1936, and N. M. Wrong, writing in the *Canadian Medical Journal* of 1935. Many other observers record their use of the patch test with the same results.

Foerster emphasizes the facts in the differential diagnosis of occupational dermatoses as regards pre-existing and co-existing syndromes, and their part in the development and prognosis of an occupational dermatosis. He states that a non-occupational origin should always be sought for in cases of supposed trade dermatitis. It is too commonly assumed that a dermatitis, particularly a dermatitis venenata, has resulted from the work, especially if the occupation is one in which dermatoses are present. A potent cause of occupational dermatitis that is often overlooked and is entirely preventable is the use of turpentine, benzene, and abrasive soaps in the removal of paint, grease and dirt. Fungus and bacterial infections and allergic conditions are frequently causes of confusion in diagnosis and prognosis of industrial dermatoses.

A few writers are not in accord that the patch test has such great value. In the annual report of the Chief Inspector of Factories and Workshops of Great Britain, the following statement is found: "The value of patch tests in elucidating the problems of industrial dermatitis has been carefully considered, and the conclusion arrived at is that these tests are sometimes of corroborative but rarely of primary diagnostic value in this connection, and furthermore, the tests are not specific." I do not find any evidence that this officer had any medical training.

Harry R. Foerster, in writing on observations of industrial dermatology in 1936, brings up some very valuable observations. He states: "It is in cases of contact dermatitis that the patch test is of value, but it must be emphasized that this test is not a short-cut to dermatological knowledge and it should not be made the basis of a diagnosis. Correctly applied and intelligently interpreted, it may be very useful but its widespread adoption for diagnosis, its loose acceptance by insurance companies, and the likelihood of faulty interpretations should result in the application of proper restrictions. We feel that the most reliable test is that of actual working conditions, but this is usually contra-indicated and is chiefly valuable in retrospect, as indicated at times by the history. Occupational trauma, sweating at work, and repeated exposures over periods of weeks and months, are some of the factors in industry leading to skin sensitization that cannot be duplicated in patch testing." He further feels that the hypersensitivity that resulted in dermatitis is often confined to the area of dermatitis and a patch cannot be applied to that site until long after recovery. If the material used in the test is in a stronger concentration than existed in the occupational exposure or is in contact over a more prolonged period of time, or is applied to an area of localized hypersensitivity, a positive false reading may be obtained. The opposite condition may result negatively. In cases of positive patch test reactions, negative control tests in normal subjects made under identical conditions are important.

Schwartz has pointed out that after a person has recovered from a dermatitis he may have become immune to the causative substances and yield a negative patch test; also if a polyvalent sensitivity has been developed the tested individual may react positively to a great variety of test materials not concerned in the development of the dermatitis. Field and Sulzberger have recently shown that the result of a patch test may depend on the site chosen for the testing and on the time of the application of the test or phase of sensitivity of the individual, and they warn against basing positive conclusions on one or a few patch tests, particularly if applied at the same time. Their experiments showed that variations in response to testing seem to depend on chronological fluctuations in degree of sensitivity which varied greatly at different times in one and the same area; and they also showed that certain irregularly disseminated, circumscribed skin areas seem consistently less sensitive than others. Foerster also points out that a hereditary, atopic dermatitis, aggravated by irritant occupation contacts may yield a positive patch test to occupational materials and thus result in further confusion.

MY PERSONAL experience with the patch test in 563 cases leads me to believe it is an extremely important procedure in delineating the contactants which may be producing the syndrome being studied. I believe we have to consider what I call the relative index of the reactions, because certain materials, like feathers, give a much lighter, fainter, yet positive reaction than stronger chemicals, etc. While the typical reaction as described by practically all investigators is that of a marked erythematous vesicular eruption, we cannot expect this from many other substances which may be tested. This one factor alone will help a great deal in enhancing the value of the patch test in suspected occupational dermatoses. The difficulties encountered in using the patch tests are many but one of the most important things is to be sure to use the correct

strength. It is obvious that serious injuries can result from using caustics, etc., in pure strength.

Goldsmith makes the statement that the proportion of cases of eczema attributed to external noxae varies with the energy expended in searching for them. There seems hardly a limit to the possible sources which include such common objects as woods, hair washes, insect powders, plants, wireless ear phones, wallpaper, etc. In any particular case the responsible substance may be detected by the patch test. The patch test is generally carried out by placing the substance in the center of a square of white lint which is kept in place by a larger square of adhesive plaster. In the case of a liquid a small piece of white lint moistened with it is covered by a somewhat larger piece of oil silk which is kept in place with plaster.

Mayer has worked out the proper strength for testing purposes of a large number of common substances: if these are laid upon the unbroken skin surface for 24 hours they produce no inflammation in normal persons. Of course, many complex substances must be used in their natural state. The following is a representative selection from his list: Silver nitrate, 10% watery solution; sodium hypochlorite, 10% watery solution; benzene, 60% in olive oil; turpentine, 50% in olive oil; alcohol, full strength; nitric acid, 2% in water; chromic acid, 0.5% in water; acetic acid, 3% in water; boax, saturated solution; peppermint, 1% in alcohol; novocaine, 1% aqueous solution of the salt; tincture of iodine, 10%; house paint, 50% in olive oil; corrosive sublimate 0.1% in water; copper sulfate, 10% in water; sodium chloride, 10% in water. He has a much larger list but these are enough to serve as examples. One must not use a corrosive or caustic substance undiluted on the integument. If accidentally irritated by such, the inference, of course, may be made by the history, dermatological picture, and clinical course.

As to the strength of materials to be used and the time element for reaction, there have been some very interesting experiments. Percival made patch tests with mercury perchloride, red mercuric iodide, chrysarobin, iodoform and picric acid on a number of non-eczematous individuals. He found that the same type of eruption which he described as eczema was produced by all the different substances, and that its intensity but not its character was to some extent proportional to the concentration. The maximal latent period was three days, but it was generally only some hours. He found that the substances fell into two groups: Group I substances which included the mercury salts and chrysarobin if in inadequate concentration produced reaction in 100% of people, while when very diluted they produced a visible effect in only a small percentage. This shows that idiosyncrasy is only a relative term, depending upon not only the nature of the substance but also on its concentration. An increase of 20 times in the case of mercuric iodide, of 300 times of mercury perchloride, and of 1000 times of mercury perchloride in vaseline over the minimal concentration required to provoke the reaction, still leaves from 5 to 18% of the individuals who do not respond. These individuals are, therefore, equally idiosyncratic with those who react to excessively low concentrations.

In summarizing a series of 1147 cases, in which 589 were considered industrial, 418 as non-industrial (ranging all the way from ringworm to herpes zoster), and 70 were doubtful, Downey, of Boston, concludes: "The patch test has been of value in determining the causative agent but is limited since the exact working conditions cannot be reproduced. A workman may show repeated negative tests with prompt recurrence on his return to work, showing the presence of an unknown factor, such as escaping fumes, heat, steam, moisture, friction or the element of fatigue. In doing patch tests with solutions, it is important to know the chemistry of the solutions before attempting to dilute them with water, for if some solids are soluble only in strong acids and others in strong alkalis, their dilution may produce a preparation which will give a false positive reaction; this is especially true with alcoholic solutions. It is recommended that one inspect a man's work and then secure samples for testing." The chief causes of industrial cases in this group were solvents, cleaning fluids, soaps and chemical detergents. In Downey's experience, superficial fungus infections (ringworm) comprised a large group of non-industrial cases.

Many writers point out and emphasize the extreme difficulty of differentiating eczematous epidermophytids from other eczematous eruptions of the hands. A primary or actual fungus infection may be recognized by its clinical appearance, namely, the eruption manifesting itself by a sharply defined undermined edge with centrifugal spreading and enlarging by the formation of deep seated vesicles at the periphery. Supportive evidence may be found on the feet or some of the other intertriginous surfaces. The finding of fungi is desirable but not always possible. The allergic eruptions are often associated with other allergic states, as hay fever and asthma.

Conclusions

INDUSTRIAL dermatosis are common and are usually eczematous.

2. Eczematous eruptions of this type are due to contactants.

3. In this type of occupational cases, the patch test is of great importance in detecting the agent.

4. The clinical test must also be used to aid in the determination of the cause in many cases.

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Railway Surgeons' Congress

—Forty-Ninth Annual Meeting: Chicago, September 19, 20, and 21, 1938—

THE Program for the Forty-Ninth Congress of Railway Surgeons is tentatively outlined as follows:

Monday, September 19:

"Amputation Stumps of Lower Extremity," by R. HOUSEHOLDER, M.D.

"The Surgery of Peptic Ulcer," by HOWARD K. GRAY, M.D.

"Diagnosis of Acute Abdominal Pain," by H. IVAN SIPPY, M.D.

"Relation of Dental Pathology to Remote Body Pain," by ROBERT L. LADD, M.D.

"The Neurological Component of a Physical Examination," by LEWIS J. POLLOCK, M.D.

"The Relation between Arthritis and Injury and Injury and Arthritis," by PAUL B. MAGNUSON, M.D.

"Interesting X-Ray Problems," by HOLLIS E. POTTER, M.D.

"Transportation and Treatment of Fractures," by JOHN R. NILSSON, M.D.

Tuesday, September 20:

"Clinical Aspects of Cardiovascular Disease," by ROY W. SCOTT, M.D.

"Hyperparathyroid Disease and Manifestations of Interest to Industry," by EDWARD P. HELLER, M.D.

"Lumbar Vertebral Fractures, Non-Operative Treatment," by B. V. MCCLANAHAN, M.D.

"The Surgical Treatment of Bronchiectasis," by JOHN M. DORSEY, M.D.

"Appendicitis," by J. W. BARKSDALE, M.D.

"Mental and Emotional Instability, a Problem of Late Mid-life," by GEORGE T. HARDING, M.D.

"Trauma of the Larynx," PROFESSOR CHEVALIER JACKSON, and PROFESSOR CHEVALIER L. JACKSON.

Wednesday, September 21:

"Bone Traction Splint for Fractures of the Humerus," by T. VAN BOYD, M.D.

"Nerve and Muscle Injuries," DEAN LEWIS, M.D.

"Pneumonia in Industry," by GEORGE F. O'BRIEN, M.D.

"Plastic Surgery," by VILRAY P. BLAIR, M.D.

"Injuries and Tumors of the Spinal Cord," by WALTER E. DANDY, M.D.

"Surgery of the Colon," by VERNON DAVID, M.D.

Midwest Safety Conference

—Abstracts of Proceedings of the Occupational Disease Sessions of the Sixteenth Annual Meeting, at the Hotel Sherman, Chicago, May 17-18-19, 1938—

THE Occupational Disease Sessions of the Sixteenth Annual Midwest Safety Conference were held at Hotel Sherman, Chicago, Wednesday, May 18, and Thursday, May 19, 1938.

The subject for the first session was "Elimination and Control of Health Hazards of Common Industrial Processes." HONORABLE PETER J. ANGSTEN, Chairman, Illinois Industrial Commission, presided. The program was as follows:

"Metal Cleaning Processes."

(a) *"Solvents,"* by DR. A. L. BROOKS, Medical Director, Fisher Body Detroit Division General Motors Corporation, Detroit, Michigan.

(b) *"Pickling,"* by MYRON A. SNELL, Engineer, Hartford Accident and Indemnity Company, Chicago.

"Painting Practices."

(a) *"Materials,"* by DR. ALICE HAMILTON, Medical Consultant, Division of Labor Standards, United States Department of Labor, Washington, D. C.

(b) *"Methods of Use and Application,"* by CLARK D. BRIDGES, Safety Director, Casualty Mutual Insurance Company, Chicago.

The subject for the second session was "Industrial Sanitation and Hygiene." OLIVER E. MOUNT, Secretary and Assistant Treasurer, American Steel Foundries, Chicago, and Chairman, Employer Group Members Advisory Committee to the Industrial Commission, presided.

The program for this session included the following speakers and subjects:

"Inspecting the Plant for Health Hazards," by DR. M. H. KRONENBERG, Chief of Division and Industrial Medical Supervisor, Division of Industrial Hygiene, Department of Health, State of Illinois.

"Plant Sanitation," by MAJOR JOEL I. CONNOLLY, Chief, Bureau of Public Health Engineering, Board of Health, Chicago.

"Hygiene," by WARREN A. COOK, Superintendent, Engineering Division, Zurich General Accident and Liability Insurance Company, Ltd., Chicago.

A feature of the second day was an Occupational Disease Luncheon, which consisted of a question-box session and at which DR. C. O. SAPPINGTON, Consulting Industrial Hygienist, Chicago, presided.

DR. A. L. BROOKS, in discussing the subject of the solvents used in metal cleaning processes, stated that in the use of degreasing solvents hazards may be involved, but if we look into the detail of the exposures, and understand what the exposures really are, there should be no hazard resulting. It is important to have a knowledge of the materials, to understand their properties, to know the nature of the exposure, to be intelligent regarding the detection of effects of exposure, and to be able to suggest a working program to the management. Various types of solvents were classified, including the aromatic and aliphatic series of hydrocarbons, the alcohols, ethers, acetates, and the like. In regard to petroleum spirits, which stand between gasoline and kerosene, Hayhurst's series of case reports was cited. As to whether there will be adverse effects of solvent vapors depends upon the concentration in the air, the respiratory rate of the individuals exposed, and other personal factors. The concentration beyond which the exposure should not go has been placed arbitrarily at 100 parts per million. Such a concentration is seldom reached in degreasing operations. For the protection of the skin, certain ointments have been used; protective gratings have been employed to stand upon; and gloves and aprons are also necessary in certain types of industrial operations. With regard to benzol, the properties and effects were detailed briefly, and special reference was made to the urine sulphate test as a measure of exposure, and also the effects upon employees. Brief mention of other solvents was made, especially with reference to their use and effects. Trichlorethylene is extensively employed now as a degreasing agent, and one must be careful to avoid open containers and exposure to open flames, since in the latter exposure phosgene may be one of the dangerous disintegration products formed. A colored motion picture showed in detail different kinds of installations, both closed and unclosed systems for the proper handling of degreasing agents in manufacturing processes. It is believed that degreasing agents can be used safely, but it should always be kept in mind that uncontrolled exposure may be equivalent to a hazard. In the discussion, DR. BROOKS brought out the points that smoking should be prohibited wherever degreasing is done, that the sideboards on certain types of dipping apparatus should be high enough to prevent the escape of vapors. DR. BROOKS has seen no systemic effects from exposure to trichlorethylene, although some cases are now being reported in this country.

MR. MYRON A. SNELL described different kinds of pickling processes. Brief mention was made of the gases evolved, but it was believed that these do not exist in sufficient amounts ordinarily to give rise to any trouble. The concentrations of hydrogen sulphide, sulphur dioxide and arsene, which are permissible were named. Many manufacturers make use of so-called inhibitors which may be either organic metals or synthetic organic commercial compounds, the latter being most efficient. It is necessary to provide adequate ventilation when using inhibitors. An important process in this type of work is what is known as electrolytic pickling. In bright dipping, where copper products are cleaned by a mixture of strong acids, the oxides of nitrogen may be given off in sufficient quantities to cause some trouble. The

uses of hydrofluoric acid were also discussed. In conclusion it was stated that mechanical ventilation is the real solution to these problems; one must also remove the possible toxic gases formed and improve the disagreeable surroundings which the types of manufacturing involved may create.

DR. ALICE HAMILTON, in discussing health hazards in relation to materials used in painting practices, stated that great changes had taken place in the painters' trade during the past 25 years. Formerly we were concerned with a few substances, such as lead, turpentine, and wood alcohol. Now we are dealing with numerous substances of unfamiliar type. It is said that over 100 kinds of solvents are now used in various types of coatings. The principles by which difficulties may occur are accidental contamination, heat, hard work and other extraneous factors. There are a great many new nitrocellulose lacquers, and also synthetic resins. The hydrogenated naphthalenes are very important in this field. Enamels are also used in about 40% of the automobile industry. Regarding alcohols, no difficulty has been experienced with butyl or isopropyl alcohols. Methyl alcohol at the present time is our chief concern in relation to this group. The acetates are not so important, but can produce temporary irritation, which is also true of acetone; butanone possesses sufficient irritant properties to provide a warning. The glycols are assuming more importance, and it has been shown that some of the cellosolves are injurious. Benzol is still a menace in the painters' trade. In the building trades, a new substance has been used as a coating; it is named tetra-ethyl-ortho-silicate. The painters' trade is safer than it was 25 years ago, but we demand more at the present time. The industrial physician must watch the employees and be keen to detect changes, publishing the results of his findings, so that they may be put to good use.

MR. CLARK D. BRIDGES, in speaking of methods of use and application of paints, referred to the advice of an insurance company 10 years ago: "Use only lacquers containing non-poisonous substances." There are many new compounds being used in the field, and this is the reason that it is necessary to emphasize that a chemist is not really a toxicologist, and also that many new compounds are not well understood even by those manufacturing them. We must also consider what may be called "legal exposure." In spray painting, for instance, the operation should be isolated to limit actual exposure and legal exposure. An excess ventilation of 10% should be used for a margin of safety. One must not forget the possibility of there being carbon monoxide generated from the dryers, and proper exhaust should be put up to take care of this problem. Shallow booths present problems, and it has been found that the baffles to prevent contamination of the fans and the duct should be installed originally, or the fan speed properly adjusted. The velocity of the air is a moot question, there being variations of from 110 to 400 feet per minute provided; perhaps an average of 150 feet per minute would be advisable at the present time. A discussion of duct fundamentals was given. The discharge of ventilation must be far enough removed, so as not to come back into the room, and a number of instances were noted of where this was not done. Fans must always be adjusted so that they turn the right way. In spray painting, one foot is about the desirable distance for the application of the spray. In these processes, if ventilation is not sufficient, an airline respirator provides the proper protection. Dermatitis is the chief effect resulting from the hazard, and attention should be given especially to the matter of not allowing men to wash their hands directly in the solvents. Medical supervision is a very important problem and must always be done by qualified men. In conclusion, there is no standard formula for the prevention of occupational difficulties arising from painting practices — materials must be carefully and properly handled and the necessary protection must be afforded, with proper check-up and medical supervision.

The second session on occupational diseases on Thursday morning, May 19th, was on the general subject "Industrial Hygiene and Sanitation."

DR. M. H. KRONENBERG, in discussing the subject "Inspecting the Plant for Health Hazards," stated that his paper dealt with a few of the essentials paramount to revealing and uncovering sources of ill health in industry. A slide was shown comparing the death rates by occupation among professional men, and skilled, semi-skilled, and unskilled workers, thus establishing a focal point to which attention should be directed in preserving the health of the industrial population. Today the inspection of plants for health hazards necessitates a well-organized program and qualified personnel, which must be just as well organized as the staff of the works manager or the sales department. Such an undertaking requires extensive field and laboratory equipment. Inspection procedures partake of three phases: (1) the preliminary or visual survey; (2) an exact quantitative study of the potentialities revealed by the preliminary study; and (3) an occupational morbidity and mortality study. Slides showed the form used by the inspector in checking workrooms and departments to gather information concerning each occupation. Another form which was shown is used to go through the entire survey, picking out exposures and placing them in a column particularly adapted to this purpose, in which a system of symbols or codes can be used to identify exposures. (This is known as Form 1-A.) Another slide was shown depicting Form 2 which is used to tabulate the number of workers exposed, in each workroom and department, to the various hazardous materials and operations. Other forms were shown, segregating departments and occupations with reference to workers and exposures; also forms for the recording of control measures used. A quantitative study of conditions involves air

sampling of the workroom environment and the analysis of materials and samples by precise mechanical and chemical methods. A very important angle of the work is the accumulation of morbidity and mortality figures, which are lacking for the most part in American industry. Such figures point to conditions and departments where high rates prevail and thus give a lead to the difficulty. The personnel involved in this type of work was also given detailed consideration, including management, the physician, the engineer, foremen and supervisors, the employees, the nurse, and the safety director. In conclusion, a workable method for a health audit of the plant together with consideration of the personnel involved was given in this paper, and the details were referred to on forms which can be of great help in setting down a record which will be of value in the future.

MAJOR JOEL I. CONNOLLY presented the subject "Plant Sanitation." Plant sanitation problems are always changing, owing to improvements made in industry through the introduction of new substances and processes. Improvement in the environment involves cleanliness of the plant, cleanliness of the workmen, pure air to breathe, pure water to drink, protection against excessive noise and vibration, sufficient light without objectionable glare, adequate toilet facilities, suitable conveniences for lunchrooms and smoking, being surrounded by other workers who are healthy, correct posture while at work for the prevention of unnecessary fatigue, the attitude of the workmen toward the use of protective devices, and provision of adequate medical and nursing services. The details for each of these provisions were well represented and discussed at length. It frequently happens that a hazardous condition is discovered before damage is done. Because no one is made sick or killed by a dangerous condition, the lesson which should be learned is frequently overlooked. An example of this sort was given of a cyanide tank in a silver-plating establishment in a large office building; during the course of inspection of the plumbing in the building, it was found that the submerged outlet to this cyanide tank would permit siphonage of the tank contents into the drinking water system, where 30,000 persons were employed constantly, on an average of six days a week. It takes no stretch of the imagination to picture what would have happened had the Board of Health not discovered the dangerous condition and had it remedied promptly. A hazardous condition in the plumbing fixtures of a plant may exist for a long time without causing trouble in some cases, but this is no guarantee that it may not cause trouble tomorrow. For instance, one epidemic occurred in a plant which had been shut down for a long time and was reopened by men who had not had experience with that particular kind of plant and who did not, therefore, know about the existence of cross-connections in the piping system. After giving details on the various types of equipment to be installed and the supervision of such equipment, Major Connolly concluded with the problem of educating employees; they should be taught that the use of washing facilities, lunch rooms, smoking rooms, respirators, and other things provided by the management are there because the workers need them. If employees are taught to recognize the need of such things for their own protection and not to regard their use as simply compliance with a wish of the management, the safeguards will be used very much more effectively.

DR. C. O. SAPPINGTON, in the absence of Mr. Warren Cook who was originally scheduled to appear, spoke on the subject "Plant Housekeeping, Plant Sanitation, and Plant Hygiene." Emphasis was particularly placed on plant hygiene, since this is the only rational method of discovering and controlling health hazards which will produce occupational disease. One may have an ostensibly clean plant so far as visual inspection is concerned, and still have health hazards which can produce occupational disease. The hazards which actually cause occupational disease may be designated "hidden hazards," requiring the use of instruments of precision and quantitative analytical methods to discover the nature and amounts of substances in the air or in the environment which may constitute the hazard. The details of industrial hygiene activities with reference to industrial hygiene surveys and studies were given, with accompanying comments regarding the preliminary or visual survey, the technical survey, the evaluation and interpretation of results, and follow-up methods. Lantern slides were shown depicting recent modifications of types of apparatus to be used for sampling procedures in industry and also the various devices for direct estimations of injurious gases or vapors or other substances in the air. Particular attention was given to the functions of the safety engineer with reference to prevention programs with regard to occupational disease. As a powerful argument for the prevention of silicosis, cost figures for the compensation of silicosis for the year 1936 in the State of Wisconsin were quoted from lantern slides. Many people look upon silicosis as an unimportant disease because of its relative infrequency—although it is not rare, it is not common. However, figures relative to the cost of compensation for silicosis cases closed in the State of Wisconsin for 1936 revealed definite evidence to the contrary: although "noxious dusts" with 71 cases, aggregated only 6.6% of the total number of cases of occupational disease disability indemnified during 1936, the payment of compensation for these cases aggregated $119,737, or 54.4% of the total occupational disease compensation paid as noted. Furthermore, silicosis when compared with chief causes of injury, stood second highest in average compensation costs among the fatal cases, first among the permanent total disability cases, and second among the relative permanent partial disability cases. We, therefore, conclude upon this evidence that the severity of silicosis is the highest of any occupational disease of which we have adequate records at the present time.

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VOLUME 7 JULY, 1938 NUMBER 7

The Convention

A WEALTH of brilliant thought, and a world of competent experience went *into* the preparation and delivery of the 35 presentations on the program of the Twenty-Third Annual Meeting, and Second Conference on Occupational Diseases, of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, at Chicago, last month.

And so much information came *from* those presentations—interesting, authoritative, instructive, and thought-compelling in these times of grave problems and difficult solutions—as makes their total bulk of cyclopaedic size and textbook value.

The range of subjects unrolled the whole long panorama of employee fitness. And the afterview is educational, indeed, in the appreciation of how very long that is.

The well employee was studied among his hazards—and these went far beyond diseases, for hazards lurk in water as well as air, and the kind of sickness of which a developing inefficiency is the first apparent symptom thrives in noise and loves the shadowed light. And the hazards were studied—diseases and all—from the various aspects of elimination; or, failing that, of control; or, where that was late, of proper compensation—each carefully canvassed in the three relations of engineering, insurance and legislation.

And the sick employee was studied in all the terms of examination, diagnosis, and treatment—nurse, physician, surgeon and consultant bringing their experience and ability to bear upon his ailment, whether it came upon him *from* his work or *in* his work, or, as in some cases, came with him to his work.

And the ex-employee was studied—the silicotic, as to his employability, and the disabled, who had been on compensation, as to his.

And even the unemployable were studied—those who can and will work, but present a disability or disease which, in case of compensation, would add to the responsibility of, and the cost to, the employer.

Altogether, this was a program of remarkable completeness and outstanding and permanent importance. And there is even some probability that its corollaries of discussion will develop an historical significance. This might eventuate from either or both of two acts of the Association: one, the resolution regarding the employee found to have syphilis (see page 419), and the other the decision to create a committee for the study of the problem of the applicant for employment who presents a disability or disease (see page 436).

Appointments of committees are common enough in all kinds of organizations. Committees may or may not develop a significant report, and if they do, it may or may not be adopted. And so the real effectiveness of this suggested study of the problem of the disabled or diseased applicant for a job is a matter of the future. It is hoped that this study will be seriously undertaken and seriously and thoroughly made, to the end that an unintended restriction of certain of the existing compensation laws may be removed.

But resolutions, such as the one that climaxed the discussion of DR. VONACHEN's paper are rare among professional associations. They require too much extra-professional assertiveness to be otherwise. The A. A. I. P. & S., however, had the professional courage, and the professional and extra-professional independence, to do what it did. From the standpoint of its own relation to industry, and the integrity and importance of its own efforts in and for industry, it was decidedly the thing to do.

And so once more it leads, and points the way. And already its example hears a powerful echo in the recent (June 24) recommendation of the board of directors of the Illinois Manufacturers' Association to its 2,800 members that "each industry institute a syphilis control program without discrimination against infected workers."

And thus, prolific of enhanced values in every department of its interests, productive of stimulating suggestions and ideas, and assertive of the strength and integrity of its own professional status, the A. A. I. P. & S. adds another successful convention to its number, and enters upon another interim of greater and more important service.

Occupational Diseases and Industrial Surgery

Fitness and the Industrial Worker

LEONARD P. LOCKHART, M.D.

THE title chosen for this lecture needs a little explanation.* The industrial worker is not a special kind of individual for whom it is desirable to plan a course of exercises. On the contrary, there is no modern word quite so wide in its scope as "industry" and no human being who ought not in some measure to be included in the term "worker." But even if we narrow the issue we are still dealing with nearly one-third of the entire population in occupations that vary from coalmining to seafaring and from employment in factories to work in offices.

To consider "fitness" in relation to some 10,000,000 people is no small order. But what is "fitness"—fitness for what? Fitness, I suggest, so to live the working part of life that it contributes in full measure materially, physically and mentally to the enrichment of the individual and to the material welfare of the community. The quest for fitness must not degenerate into a stunt, nor must it benefit sectional interests at the cost of the general community.

Accidents

THE foundation of all industrial fitness is obviously that accidents and hazards be reduced to a minimum. Under the efficient control of the Home Office we are able to do a great deal to prevent accidents and to minimize the effects of those we cannot yet prevent, but there is still much to be done. The proper design of machinery, the effective safeguarding of various processes, and the education of young workers in the use of the machines they operate, receive detailed attention under the Factories Act, but no law can by itself deal with these things.

The percentage excess of accidents among young persons as against adults as given by the Chief Inspector of Factories is as follows:

Year	Percentage increase
1928	3.0
1929	10.0
1933	10.0
1934	19.0
1935	22.0

In 1936 10.4% of the boys and 24.4% of the girls who were injured during the first six months of employment were injured in the first week.

The law insists on proper apparatus, but again it cannot compel wise heads. It is therefore necessary that employers should see that there are enough properly trained people available to do what is necessary according to circumstances in the event of accident. The first aid treatment of injuries leaves much to be desired, so too does the degree of cooperation between the hospitals which treat accident cases and the industries which must help to rehabilitate and re-employ them.

Injuries to bones and joints should never, if there is any marked degree of pain, be dismissed as "only a sprain." An x-ray is often the only method of deciding between what is trivial and what is serious. First aid should be confined to the application of a suitable dressing and should never include probing about in a wound or in an eye for some splinter or foreign body, nor should a person with a sprained ankle be encouraged to walk on it till medical advice is obtained.

This may sound elementary, but there are far too many cases of sepsis and other complications arising from "minor" injuries and burns. Fitness is dependent on some knowledge of how to deal with life's risks and emergencies; each individual has a personal responsibility in the matter, and should learn where first aid ends and medical or nursing care begins.

The Positive Aspect of Fitness

THE proper selection of entrants into industry is most important, because different jobs demand different physical and mental qualities, and it is our business to see that as far as possible people get the jobs they are best fitted for, and, if possible, the jobs they want to do. Whatever the basis of selection is, we must be sure that we do not create a scrap-heap of rejects who are failed merely because they do not come up to some arbitrary standard of fitness. It is still quite common, for example, for an applicant to be rejected merely because he is wearing glasses, even though he can see well with them and inadequately without them. Our object must always be to employ the applicant if we possibly can. This means considering whether certain jobs cannot be done quite well by people who are crippled, by some who are not educationally very well equipped, and even by some who are not very bright. The test must be—can this man, boy or girl do, or be trained to do, the job well, earn a decent living, and so become capable of getting the best out of his or her life? If we begin to think of industrial fitness in terms of Olympic champions and perfect minds and bodies we shall go wrong, because it frequently happens that a job is essential to earn the money to buy proper food and that, with this improved feeding, the individual develops. The experience in the Army with sub-standard recruits is a marked case in point. I would go further, and say that to make a policy of employing people whose capacities are far in excess of the demands to be made on them is anti-social.

We have got to enable the bulk of our people to get as near to fitness as they can, and that means they must have jobs, and these jobs must be suitable for them, and they must be able to make a reasonable show at the work. The most unlikely-looking people often do well given a chance and given a reasonable and proper training. Too many people want to scamp the training. If this is to be avoided it means that supervisors and foremen must be selected with special care. They must certainly know their jobs well but, in addition, they must be good teachers. This calls for the right personality, patience and determination. Far too many people are allowed to rot because no one has the patience to teach them properly. I believe that resentment at being improperly taught the job causes as many misfits as almost any other single cause. The highest efficiency and the happiest work comes from well-trained people who serve under good supervisors. Work is a part of our total life and must be regarded as such. That one should be well adapted to it is an absolute essential of ordinary health and happiness. This cannot be too strongly emphasized.

Having selected a staff and supervisors to the best of one's ability, how can we further improve fitness in general? In two ways—attention to the mind and attention to the body. It is a truism that mental peace, balanced and emotional stability make for health and physical well-being. We must therefore see what we can do to keep or improve this balance.

We are endowed with two definite parts of the mind: the intelligence and the emotions. We *know* by the former, we *feel* by the latter. So far as health is concerned, the emotions are of vital importance, because fear, anxiety, joy, sorrow, hatred, love and jealousy can deflect and distort the whole stream of our being. On the other hand, we cannot get on in the world, meet its emergencies, carry out our duties, or even keep well if we do not use intelligence, but a peaceful temperament is the keystone. In cooperation with foremen and supervisors, the doctor has a wide field of service in this aspect of man-

* From *Labour Management*, June 1938, with this comment: "This article is slightly abridged from a lecture under the auspices of the Board of Education and the British Medical Association delivered for the National Fitness Council at the Ideal Homes Exhibition, Olympia, 19th April, 1938. We are very much indebted to Dr. Lockhart and to the British Medical Association for permission to use this paper.

THE AMERICAN ASSOCIATION of INDUSTRIAL PHYSICIANS and SURGEONS

Component Societies

Central States Society of Industrial Medicine & Surgery

Association for the Advancement of Industrial Medicine & Surgery

THE object of this Association shall be to foster the study and discussion of the problems peculiar to the practice of industrial medicine and surgery; to develop methods adapted to the conservation of health among workers in the industries; to promote a more general understanding of the purposes and results of the medical care of employees, and to unite into one organization members of the medical profession specializing in industrial medicine and surgery for the mutual advancement in the practice of their profession.

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agement. So often actual ill-health is caused by excessive anxiety to do well, by conflicts set up by jealousy, by fear of economic facts—losing the job or losing one's health, or by disappointment at the lack of opportunity for ambition or responsibility.

A set of girls had to pick the stems off raspberries in a jam factory. The fruit was set out in great skeps, and no matter how hard they worked, the skeps seemed to remain full of unpicked fruit. The girls got bored. Someone thought of putting the fruit into a number of small baskets and then, as the empty baskets piled up, the girls could see some result from their work. They had an index of achievement. They were much happier and got through much more work. Boredom kills efficiency, but it does more—it lowers the whole tone of the body and makes people less fit. Making work interesting is, therefore, part of good management.

Some people have little tricks they feel they must indulge. If they can check work their own way or do things by a particular method they are happy. If they cannot, they get irritable and worried. Everyone should be allowed, if possible, to do things by individual methods, provided they get the result. How often is a young worker dubbed as no good, slow and unintelligent when, in actual fact, he or she is merely one of those highly-intelligent people who have the misfortune to feel compelled to check over their work unnecessarily, or who are impelled to make mistakes when being watched. These valuable lives are often wasted because no one understands what is wrong. Ask any group of intelligent people how many of them have these little compulsions and oddities. You will be astonished at the number. Industry is not so replete with ability that it can afford not to study human beings, to discover talent and to develop it.

Sound labour management needs a great deal of human wisdom, and it needs technical medical and psychological advice, for it must have knowledge of certain essential physical facts of human life. Such things as ventilation and proper temperature make a great difference to fitness. A cool stimulating atmosphere is better than a hot, dry and enervating one. In a good atmosphere the skin is stimulated, and less clothing can be worn provided a reasonable temperature is maintained. Most people wear too many clothes, and wonder why they catch cold. The skin is a wonderful heat regulator provided it is not paralyzed by being kept too much wrapped up, and provided that the feeding is correct and adequate.

Good lighting is important for fitness—daylight if possible (clean windows let in more than dirty ones!) Proper seating is essential if fatigue is to be prevented. The word "fatigue" is used here in its true sense—tiredness due to excessive activity. Much that is often called

fatigue is merely boredom and responds to different methods of treatment, *e.g.*, improved conditions of work. Bad shoes are a very common source of fatigue. To stand all day in shoes that throw the body weight into faulty positions, that cause the ankle to wobble so that muscular action is in constant demand, or that cramp the feet, is bound to detract from fitness. Even worse is the short or narrow shoe that deforms the toes and which then gives rise to corns on the upper side of the toes or causes bunions. Women who stand all day in high heels are asking for trouble, which may vary from backache to a sense of being "all in" at the day's end. Wet shoes and stockings must be changed while at work and properly dried. Many people suffer greatly with feet at work because indoors they wear impervious soles, which are splendid for wet weather, but which cause the feet to perspire. Sodden feet caused in this way are very painful. Plain leather shoes for factory wear, and boracic powder between the toes, will generally clear the condition in three or four days.

To make for fitness in regard to work, one must be properly fed—before work, at work and after work. Breakfast is a necessary foundation, and it should supply energy for the day's efforts, and should therefore contain, beside bacon or egg, a proportion of energy foods such as porridge, bread and butter, jam, sugar and fluid. So many, particularly the young, who need it most, neglect breakfast. Young workers often get up late and miss their food because of lack of sleep. It must be so arranged that a young worker gets nine hours' proper sleep, in fresh air, with open windows, and without avoidable disturbances. The sleep of adults can be gravely upset by irregular shifts, by excessive overtime, and by improperly organized night work. The schemes for this type of work should, whenever possible, be discussed with the men in advance. An agreed scheme always works best, and cooperation is rarely lacking from the workers.

On feeding, Dr. Lockhart recommends milk, fresh herrings, and for workers in hot processes a little extra salt. He also recommends the hobby of gardening, good holidays with pay, rest pauses with a trolley canteen service.

Physical Exercise

EXERCISE should aim at producing a full and balanced bodily development, including heart, lungs and skin, and thus enabling the urban worker to attain the full standard of mental and muscular harmony which an open-air existence would ensure. Different ages and differing occupations call for varying methods, which need full consideration, and violent exercise is not a panacea for all ills.

When you are considering physical exercise, however, remember two

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classes of persons for whom they are certainly not suitable: (a) those who are improperly fed or under-slept; (b) those who are fatigued or out of condition as a result, among other things, of oversmoking. If attractive opportunities are provided in industrial areas people will avail themselves of them soon enough, but a most urgent need is for playing fields in summer and for halls in winter. These should be open on Sundays, the only whole free day the worker has. We cannot, however, regard these things as substitutes for attention to the hygiene of work, to proper labour management within industry, to the provision of proper gardens on housing estates, and to the vital correlation between rents and fares—the combination of these two items is such that proper feeding becomes an impossibility for thousands of workers, adult and juvenile. Finally, more attention and care should be given to the supervision, medical and educational, of the young worker. We must look at all fitness campaigns as being wide in scope, as taking in the *whole* of life, and not being in any way exclusively concerned with one aspect.

After dealing with three recent pieces of legislation, the extension of medical benefit to juveniles, the Factories Act, the Education Act 1936, Dr. Lockhart insists on the need for proper dental care for young people.

Many people, including public servants in uniform, wear too thick and hot and tight clothing. The whole matter needs education of the wearer and more insight by the employer. It would be a step towards fitness if we could get outdoor workers to strip to the waist in summer as the French and Germans do. The climate is suitable for at least five months of a year. There are also too many growing lads tightly buttoned into uniforms that do not grow with them. Round shoulders, narrow chests and definite stunting of growth result.

Lastly, I come to an essential of all fitness—the restoration of the unfit. The unfit are the unemployed, the injured, the sick, the incapacitated, and those who have had the misfortune to fall into crime and suffer imprisonment. All in their different ways need rehabilitation.

Fitness of the industrial worker is a big subject. I have dealt with it inadequately and in uneven patches, but my object has been twofold: (1) to raise interest in the whole rather than part of the field, and (2) to go into a little detail with regard to those things on which each one can do something in a practical way.

Just a word on medical services in industry. In addition to accidents there is much that calls for medical advice in regard to the employment of any large number of people. Much incapacitating sub-standard health is due to factors within industry, some physical, some emotional. A great deal can be done to overcome these

difficulties. Young people can be piloted through adolescence; staff departments can be advised on matters of health and welfare, "misfits" can be helped to readjust, and an attitude of scientific humanism can be encouraged in organizations. Admittedly, this looks rather like a scheme for large firms, but there is no valid reason why several small firms should not pool their resources for some sort of part time medical supervision. Developed in the right spirit, it helps. In the wrong spirit and without the cooperation of the worker, like any other scheme, it fails.

As regards the main theme of this lecture, it is a national one, and we have to look into the future and see that in this country industry shall become, in its widest sense, a social service in which the worker reaches that state of fitness for his task which can only be fully achieved by well-informed members of a free society working together. We are told we are a decadent or C3 people. That is false. We have a wonderful heritage, but during the Victorian age our population passed through a bad illness — the rapid and uncontrolled growth of urban industrialism. We then suffered grave loss in a disastrous war. Now if we are to regain and increase our vitality we have to study fully, and with open minds, the nature and nurture of men in the widest sense. It is a creative task of immense importance and something invigorating and encouraging to tackle which, if carried through successfully, will bring great benefits to a temporarily saddened and distracted world.

Texas Railway Surgeons

THE Texas Railway Surgeons Association held its twenty-second annual meeting in the Terrace Dinning Room of the Hotel Galvez, Galveston, May 9, with an attendance of 95 members.*

The treasurer reported about 400 members had paid dues, and a cash balance on hand December 31, 1937, of $821.13.

The Association voted unanimously (1) to change its name to the "Railway and Traumatic Surgical Association;" (2) to admit to membership any reputable physician and surgeon interested in industrial and traumatic practice; (3) to continue the present membership dues of $1.00 per year; (4) to adopt the same regulations governing the selection of honorary members as those of the State Medical Association, and (5) to authorize the secretary to publish notices of the change in name and to announce that all reputable physicians and surgeons interested in industrial and traumatic practice are eligible to membership. According to the secretary, Dr. Ross Trigg, of Fort Worth,

* *Texas State Journal of Medicine*, June, 1938,

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the Association expects to double its present membership of about 400. Dr. Trigg points out that industrial and traumatic practice is becoming a more and more important field because of the wide distribution of oil fields, industrial growth, and the increasing frequency of serious automobile injuries, which makes it necessary that doctors in rural districts and smaller towns engage in the practice of industrial and traumatic surgery. It is the latter group of physicians which the Association hopes to interest in its activities.

Thirteen new members were added to the roll at the meeting.

The following officers were elected to serve during the ensuing year: Dr. A. L. Ridings, Sherman, president; Dr. G. V. Brindley, Temple, first vice-president; Dr. Joe Becton, Greenville, second vice-president; Dr. Ross Trigg, Fort Worth, secretary-treasurer.

Occupational Disease Claims in Ohio

A SUMMARY of the occupational disease claims filed during 1937 shows a marked increase over previous years.* In 1936 the total number of claims filed was 1,388, while in 1937 the total was 1,694. It should be noted, however, that these totals are based upon the applications that are made and do not indicate that each claim meant that a compensable occupational disease existed. One hundred and fifty-six of these claims were filed for conditions which were not included in the schedule of compensable diseases and were, therefore, tabulated as non-compensable at the time of filing. In this group there was an increase of 47 claims over the previous year.

As usual, skin diseases were responsible for a very large percentage of the claims filed, the total in this classification being 1,120 claims, or 155 more than in 1936. In further analyzing the claims filed for skin diseases it is found they have been classified as follows according to the probable causes. Those due to oils 37; cutting compounds or lubricants 210; dust 365; liquids or solutions 394; fumes, gases or vapors 24; chromium ulceration of the skin or nasal passages 89, of which 60 were for skin ulcerations and 29 for ulceration of the lining of the nose.

There was also an increase of 95 claims for lead poisoning, with a total of 209 filed. This marked increase was due largely to unusual outbreaks of lead poisoning among the employees of three plants. In one plant there were 25 cases, in another 50 and in the third 12, making a total of 87 claims. Two of these plants were engaged in the manufacture of automobile and truck bodies and the cases of lead poisoning resulted from the inhalation of dust caused by the grinding of metallic lead used for

* *O. I. C. Monitor*, June, 1938.

filling cracks and seams in the metal bodies. The other group of cases occurred in a glass plant where a lead color was used in powder form and lead poisoning resulted from the inhalation of this powder. In each instance the discovery of the cause of the lead poisoning and the application of proper methods of prevention resulted in the elimination of lead poisoning among the employees.

The number of claims filed for tenosynovitis and prepatellar bursitis was 174, only three more than during the previous year. Of this number 141 were for tenosynovitis and 33 for bursitis.

Among the various poisonings, chemical and metal, other than lead, 29 claims were filed and in this group also there was an increase of about 15 claims. These were divided as follows: brass and zinc 5, arsenic 1, anilin 1, benzol or derivatives 12, carbon dioxide 1, potassium cyanide 2, volatile petroleum products 4, carbon bisulphide 1, sulphur dioxide 1, mercury 1. In recalling the consideration of these claims in the group above mentioned it was found that when further investigation was made a number of these were due to conditions other than that which was stated in the application.

On July 31, 1937, silicosis was added to the list of compensable occupatoinal diseases and after that date a number of claims were filed, but only six were considered as coming within the provisions of the law. The remainder were classed as non-compensable and included in that group. At the present time, however, many more claims for silicosis have been filed and are under consideration and investigation. National and state agencies are bending their efforts toward the control of silica dust, which causes the disease.

Eastman Announces New Three-Intensity X-Ray Illuminator

PHYSICIANS and x-ray workers (radiographic laboratories) will welcome a new three-intensity Eastman X-ray Illuminator just announced from Rochester by the Eastman Kodak Company.

A regulating switch on the 14 x 17 illuminator provides instant choice of any of three light intensities. This feature allows the user to vary illumination according to the density of each radiograph, and select the light range which best accentuates diagnostic detail.

Illumination is evenly diffused, and approximates north daylight. The viewing area has rounded corners to conform to the rounded corners of radiographs, and the angle can be varied by an adjustment on the rear support of the illuminator. The illuminator is fitted with blue-tinted, flashed opal glass which is kept cool by a clear glass baffle a few inches in front of the bulb. It is designed for either a 200-watt daylight blue frosted Mazda bulb, the special 250-watt Westinghouse x-ray illuminator bulb, or a No. 1 Photoflood lamp.

Four spring-clip fingers, uniquely designed, securely hold dry radiographs. Two convenient arms are provided to hold wet radiographs in hangers a few inches away from the illuminator frame to protect it against moisture. Construction is all-metal and exceptionally durable, with a finish of rich-grained walnut. The illuminator rests on three feet which will not scratch polished surfaces; one foot is sponge-rubber to prevent skidding.

Several improvements of the new 14 x 17 Eastman Illuminator have been incorporated in the new 8 x 10 Eastman Illuminator, also just recently announced — notably the convenient new-type clips, all-metal construction, grained-walnut finish, and switch on the front. Prices are: for the 14 x 17, $22.50; 8 x 10, $12.

Syphilis in Industry

THE recent increase in interest regarding syphilis, with its concomitant increase in activity on the part of public health and other agencies, will undoubtedly result in the discovery of a large number of syphilitic individuals in industry.

The detection of the disease in industry at the present time is principally by routine blood-Wassermann tests. Some firms are inclined to refuse employment to those found to have positive tests, and, even more serious, certain individuals already employed, having been found to have positive tests, have been summarily dismissed.

The justification for such action is expressed as follows: (a) There is considerable danger of transmission of syphilic to others; (b) a syphilitic person using dangerous machinery may endanger the life of himself and the lives of others; (c) there is additional financial risk to the company because the employee may become disabled and his disability prolonged, either directly or indirectly, because of syphilis.

Unwarranted Employee Dismissal. The use of the routine blood test as a standard for employment provides an untrustworthy yardstick for the following significant reasons:

(a) The danger of transmission of syphilis through contact not related to sexual activities is very slight, even in the case of food handlers, barbers, and beauticians. If the infection is old, there is little or no danger. If it is recent and may be classed as early infectious syphilis, the individual is immediately placed in the non-infectious group as soon as modern treatment is instituted.

(b) The only two types of syphilis which are likely to produce accidents due to sudden incapacity of the worker are cardio-vascular syphilis and neurosyhilis, the latter especially of the paretic type. If these types are excluded, there is no available evidence that industrial accidents are produced more frequently by the carelessness of syphilitic persons than by non-syphilitic workers. The diagnosis in the case of individuals with cardiovascular syphilis (who may suddenly drop dead) or those with paresis (whose judgment is extremely faulty) can be established only by careful estimation of the physical status, and, in neurosyphilis, by means of spinal fluid examination.

(c) There is no sound evidence to indicate that the syphilitic worker (excluding those with cardiovascular and neurosyphilis) is any more likely to be involved in an accident, to suffer any more serious or prolonged disability from an accident of time from sickness, or to undergo any material shortening of his life span, than any other individual. Adequate treatment would certainly tend to eliminate any small extra risk which might be inherent in the syphilitic worker.

Employer's Obligation. The employer's obligation to society and to his employees for the prevention of the dissemination of syphilis is much better discharged if the infected person is continued in his usual employment and this employment is made contingent upon immediate and prolonged treatment. If the employee is dismissed, he is immediately lost from supervised control and may have no treatment at all. As a matter of fact, the type of syphilis detected by the routine serologic test is usually non-infectious. The employer should also make every effort to keep his knowledge secret.

Strangely enough, though transportation systems such as railroads, aviation, bus and trucking companies sometimes require a negative test for syphilis as a prerequisite for employment, none of them require their employees to submit to any routine check up from this point of view. From the standpoint of public safety, a study of individuals to be found at the throttles of our transportation systems would be extremely wise, but if cardiovascular and neurosyphilis are excluded employment should be continued (or, in the case of a new applicant, granted), provided adequate treatment is available.

There is not, to my knowledge, any corporation which has required routine blood tests for its executive force. An executive with delusional trends of paresis may readily wreck a company, and if any syphilitic individual is to be dismissed on the pretext of danger to the company, he should be ousted before the minor employee whose responsibility is relatively unimportant.

From an economic standpoint, if those individuals having syphilis are refused work, only the relief agencies remain for them. If so, the cost in taxes to employers of labor to support these people will be enormous.

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* In *Digest of Treatment*, July, 1938, condensed from an article by JOSEPH EARLE MOORE, in *West Virginia Medical Journal*, March, 1938.

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